# ENGINEERING AND MINING JOURNAL

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March, 1947

MAR 20 1947

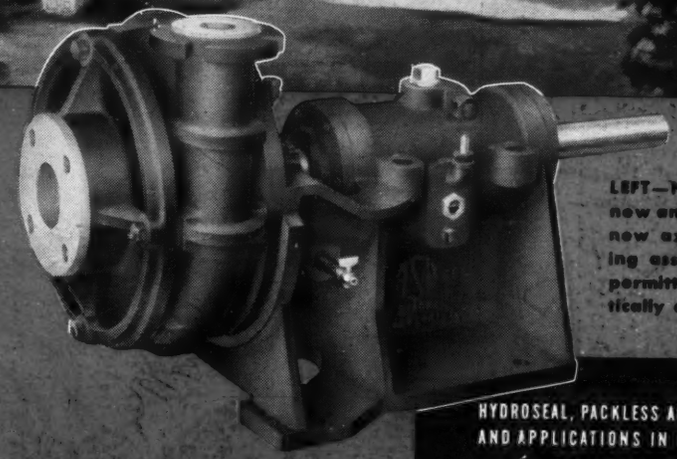
Diesel truck loading under scraper ramp in Eagle-Picher's Paxson mine. See pages 54 and 65

## Tungsten Carbide in Drilling Rock— Page 57

HYDROSEAL PUMPING SYSTEMS

## "ENGINEERED" FOR LONG DISTANCES

Hydroseal Pumps are high in efficiency and low in power and maintenance, and a carefully engineered pumping system is most economical both in installation and annual operating costs. But, pumping abrasive materials over long distances and difficult terrain requires much more than just selling pumps. So, to insure an adequate installation we will, together with you, engineer the entire system to match the reliability and economy of Hydroseal Pumps. If you have an unusual or difficult abrasives material handling job, call on the Hydroseal Engineer. He can do more than sell pumps if you need...



New Hydroseal Slurry Pump uses only 15% of the low amount of sealing water formerly required.

LEFT—New improved Hydroseal Pump with new anti-friction radial and thrust bearings, new axial adjustment of shaft and bearing assembly and new pump shell design, permitting standard pumps to discharge vertically and horizontally in either direction.

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

*Correspondence from United States and Canada to*

**ALLEN-SHERMAN-HOFF CO., 229 S. 15th St., Phila. 2, Pa.**

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# ENGINEERING AND MINING JOURNAL

MARCH, 1947

## Congratulations to the Institute!

BACK IN 1871, the columns of Engineering and Mining Journal, then only five years old, carried an announcement of the desire of Messrs. Eckley B. Coxe, Richard P. Rothwell, and Martin Coryell, all Pennsylvania mining engineers, to organize a society of mining men "to secure more economical production of useful minerals and metals and the greater safety and welfare of those employed in these industries." They agreed that a good name for this society would be "American Institute of Mining Engineers." That name, that society, and its high purpose are being commemorated this month after 75 years of service to mining.

The far-flung membership of the Institute may be interested to look back to the first meeting, held in Wilkesbarre, Pa., on May 16, 1871, to organize the A.I.M.E. Rossiter W. Raymond, then editor of E.&M.J., was secretary for this meeting, and later wrote an enthusiastic editorial commenting on the good start made. He wrote, "The new organization starts under favorable auspices, and we augur for it a career of usefulness and honor."

David Thomas, Catasauqua, Pa., was elected first president of the Institute. He was succeeded in 1872 by Mr. Raymond, who continued as editor of E.&M.J. until 1889, when he resigned to devote full time to the Institute secretaryship. For several years E.&M.J. was the official publication of the Institute until the latter's publishing needs outgrew the arrangement. Raymond was secretary of the A.I.M.E. from 1884 to 1911, and is remembered for his brilliant and successful leadership.

Raymond's foresightedness is well expressed by his favorable comment on the number of young men who attended those early Institute meetings. He went on to say, "It is into the hands of wide-awake, progressive, educated young men that control of American industry is rapidly passing." The attitude of E.&M.J. toward that trend is still the same. If the Institute continues to serve as an effective medium for the growth of young mining men its future is assured. Long life to it!

## A Bright Spot in the Mining Tax Picture

ONE of the most constructive moves in a long time in the field of mine taxation is a bill (H. B. 43) in the Michigan Legislature designed to provide tax relief to encourage mineral development.

Michigan, like most states, taxes mining properties ad valorem. The result, decried for many years by the Lake Superior region's mining fraternity, has been to discourage exploration and development beyond the necessary minimum.

The bill, sponsored by Representative Carl Lindquist of Iron County, provides a ten-year tax exemption for newly discovered ore or ore proven in the ground that is not part of the property of an operating mine. This bill, if it becomes law, should prove to be a spur to renewed exploratory activity. The tax policies of Michigan and Minnesota have been so onerous for a long time that they have driven mining companies far afield.

We salute Representative Lindquist for his foresightedness in trying to restore interest in prospecting for Michigan ores. Despite the general lack of attention to the problem of encouraging mineral development by tax relief, we consider it the most difficult and fundamental issue facing the mining industry today. Under our present tax structure, there is no logical incentive for assuming the risks of prospecting. The informed operator knows that most prospecting ventures are doomed to fail, and present taxes preclude recouping the losses from such failures from the occasional venture that results in a mine. The inevitable result of such a mineral tax policy is stifling of the domestic mining industry and furthering of the alleged have-not status so well advertised by the Interior Department and foreign trade interests for their own selfish ends.

# Commendable New Approach Toward Legislation

THE FORMULATION of the Congressional bill to establish geological and geophysical mining claims (E.&M.J., February, p. 118) has involved a fact-finding process which we suggest could be emulated to advantage elsewhere. The Subcommittee on Mining and Minerals Industry of the Senate Special Committee on Small Business, operating through its technical consultant, William C. Broadgate, has widely circulated four tentative drafts of this bill for industry and professional comment. Each new draft has been revised after study of the comments received. The result is a bill which has the advantage of being formulated in the light of a great deal of informed consideration, given at times convenient to the critics and without incidental travel expense.

Some of the provisions may not enjoy complete industry approval. For example, we believe that most mining technical men will consider a maximum holding of 640 acres too small for some geological or geophysical techniques. However, as the subcommittee states in its report, this limitation was imposed to secure the cooperation of the Bureau of Land Management, which could probably block passage of any bill of this nature to which it is unalterably opposed. Nevertheless, even proponents of larger claim areas must acknowledge that their views have received careful consideration, having been rejected only for what seemed to be good and sufficient reasons.

# Mt. Clemens Decision Not Important to Mining

THE MINING INDUSTRY is relatively lucky in knowing where it stands in the portal-to-portal issue (E.&M.J., January, p. 111), as the picture for other industries is more muddled than ever as a result of Judge Picard's recent decision, which, under his interpretation of the Supreme Court mandate, denies the workers' claims under the "de minimis" doctrine.

In our opinion, the Supreme Court did not contemplate such a result, and new complications will ensue, including controversy over the "de minimis" limitation and Judge Picard's ruling limiting retroactive collection of back pay and damages.

As for the mining industry, the Tennessee Coal & Iron decision of early 1944 remains unaltered. This supports portal-to-portal or collar-to-collar pay for all underground mines except in such unusual cases where miners proceed to their working places without hazard, inconvenience, supervision, control, load carrying, or marked exertion. Incidentally, in our opinion, these same criteria govern the basic Supreme Court definition of compensable work applying to all industry regardless of the Mt. Clemens decision, unless the Court reverses itself or Congress writes its own definition of compensable work. Even if one of these possibilities happens, there will still be doubt over Congress' power to abolish claims.

However, we find nothing in the Supreme Court decisions on compensable work that opens the door to claims for all time spent on company premises, where the employees proceed to their working places without requirements imposed by the employer or inconveniences controllable by him. The essential features bringing these preliminary activities into the compensable area are hazard, control by the employer, or exertion or inconvenience caused in proceeding on the premises to and from work. Thus, under present law, employees can probably collect on claims from and to the times they are compelled to engage in identification proceedings, clock punching, or make-ready activities. They might conceivably establish claims based on hazards, or unduly inconvenient parking facilities on the premises if the use of the parking lot is a practical necessity. There would seem to be no basis for claims over riding in company vehicles, as long as such transportation is primarily for the personal convenience of the employees and its use is not compulsory.

Referring to the change-house problem, at most mining and smelting plants the change house is furnished for the personal convenience and comfort of employees. Its use is not required by the employer or is not a necessity arising from the nature of the work. To make the voluntary use of such facilities compensable would be breaking new ground not plowed by existing decisions. This view is supported by the circumstance that the Tennessee Coal & Iron picture included a change house, and the Court, in undertaking to define what was compensable work at these operations, passed over time spent changing clothes.

Any of the above bases for claims might be voided if they are sufficiently trifling in magnitude to escape under the "de minimis" doctrine. However, we caution against proceeding under lower-court interpretations of "de minimis" limits, until the Supreme Court clarifies its meaning beyond the present phraseology, "When the matter in issue concerns only a few seconds or minutes of work beyond the scheduled working hours, such trifles may be disregarded."

Also, in view of the doubt overhanging Con-

gressional abolition of accrued claims, any employers who fear that they are liable for such claims would do well to weigh their chances for escape against the losses they might suffer through delay in settlement. The Treasury has confirmed the right to charge settlement costs against the years in which claims accrued. Nevertheless, only an act of Congress can alter the Federal tax limitation statute, which prevents refunds on closed tax returns when three years have elapsed from the date of filing the return or two years from the date of payment, whichever is later. However, refunds can be collected on returns held open by agreement between the Treasury and taxpayer for auditing and settlement.

If a corporation, hoping for a better deal from Congress or the courts, delays settlement of accrued claims sufficiently to lose the privilege of charging losses against excess-profits-tax years or of using the two-year carry-back privilege to throw losses into those years, it may conceivably lose more this way than it gains by restraints which may be imposed on accrued claims. Losses charged against excess-profits-tax years will be borne mainly by Government; those chargeable against more recent years will react principally on the employer. Furthermore, under the Treasury ruling, deductions may be denied in years of payment, even though the taxpayer is barred from reopening prior years.

# Krug Falls In With the Termites

THE RECORD SHOWS that we have earnestly sought to persuade a skeptical mining industry to meet Mr. Krug half way and bury the hatchet with respect to the points of contention that developed under "Honest Harold's" administration. Several years of official chicanery had made the industry thoroughly distrustful of the Interior Department. Nevertheless, believing Mr. Krug to be on the level, we thought we saw an opportunity to restore cooperation in both the industry's and the public interest. (E.&M.J., April, p. 67; Aug. p. 70; Oct., p. 51). We are not now prepared to make any new inferences concerning Mr. Krug personally, but we must confess that his failure to give Ickes' "termites" the boot, and the tone of the opening statement in his recent annual report, dim our hopes for constructive cooperation.

In brief, the report calls for the development of regional natural resources under TVA-type authorities, demagogically portraying the Interior Department as a champion out to prevent selfish interests from plundering the people of their rightful heritage. It coolly asks an economy-seeking Congress for a billion dollars, to be spent over 20 years, for mineral investigations. It indorses the proposed St. Lawrence waterway, and attacks the present system of establishing mineral claims as though it were another instrument of denying the little fellow his rights (See p. 87 for details).

The proposed program calls for much that is constructive in a conservational way, but underneath a grandmother's cap of beneficent objectives the reader can scarcely miss the drooling mouth and fangs of ambitious bureaucracy hungry for appropriations and power. Their desire to wipe out the remnants of control by the various states over resources and to assume industry's functions is all too evident.

The top dogs of the Interior Department have blown both hot and cold on the have-not theme until it is time that someone points out to Congress that, hot or cold, their arguments always justify more appropriations and more encroachment into the sphere of private enterprise. They have sought to frighten the public with lurid language about our alleged have-not predicament, in order to obtain vast sums for mineral investigations, then to move to the "have" side of the picture with the idea that their proposed process research would assure us self-sufficiency. They have not only allowed the popular press to confuse completely the matter of known versus ultimate reserves in portraying Interior findings, but have covertly fostered the same errors in their own propaganda. Similarly, they are now blowing both hot and cold over the self-sufficiency of the Central states. They want raw-material self-sufficiency in this area and also want a St. Lawrence seaway to provide foreign competition.

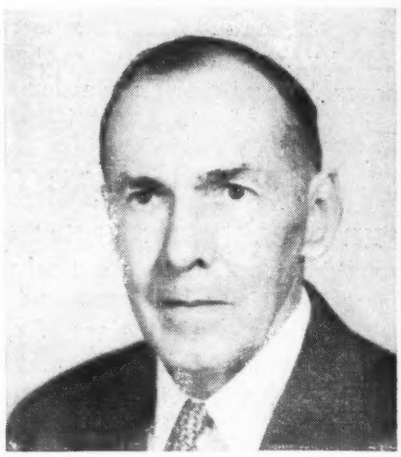
The request for a billion dollars of taxpayers' money for mineral investigations, while the mineral industry is hamstrung from doing most of the same job by burdensome taxes, is truly astounding. Likewise, is the promise that with the expenditure of any sum, however large, we would then "know what we have." Surely, in climbing out on this limb, the Secretary could not have consulted either his own men who understand the mineral industry or his new mining industry advisory committe. In fact, we understand that there is considerable indignation at lower levels over the surprise launching of this program.

Alas for our fond hopes for industry-Interior cooperation, we still believe that if Government should encourage private initiative with genuine consistency, the logical job of the Bureau and Survey would still be big enough to give them plenty to do.

# Diesel Truck Haulage at the Paxson Mine

**S. S. CLARKE,** General Superintendent of Mines, Eagle Picher Mining & Smelting Co., Cardin, Okla.

**The development described is probably the outstanding accomplishment of our generation toward making diesel engines tolerable for underground use.—The Editors.**



S. S. CLARKE

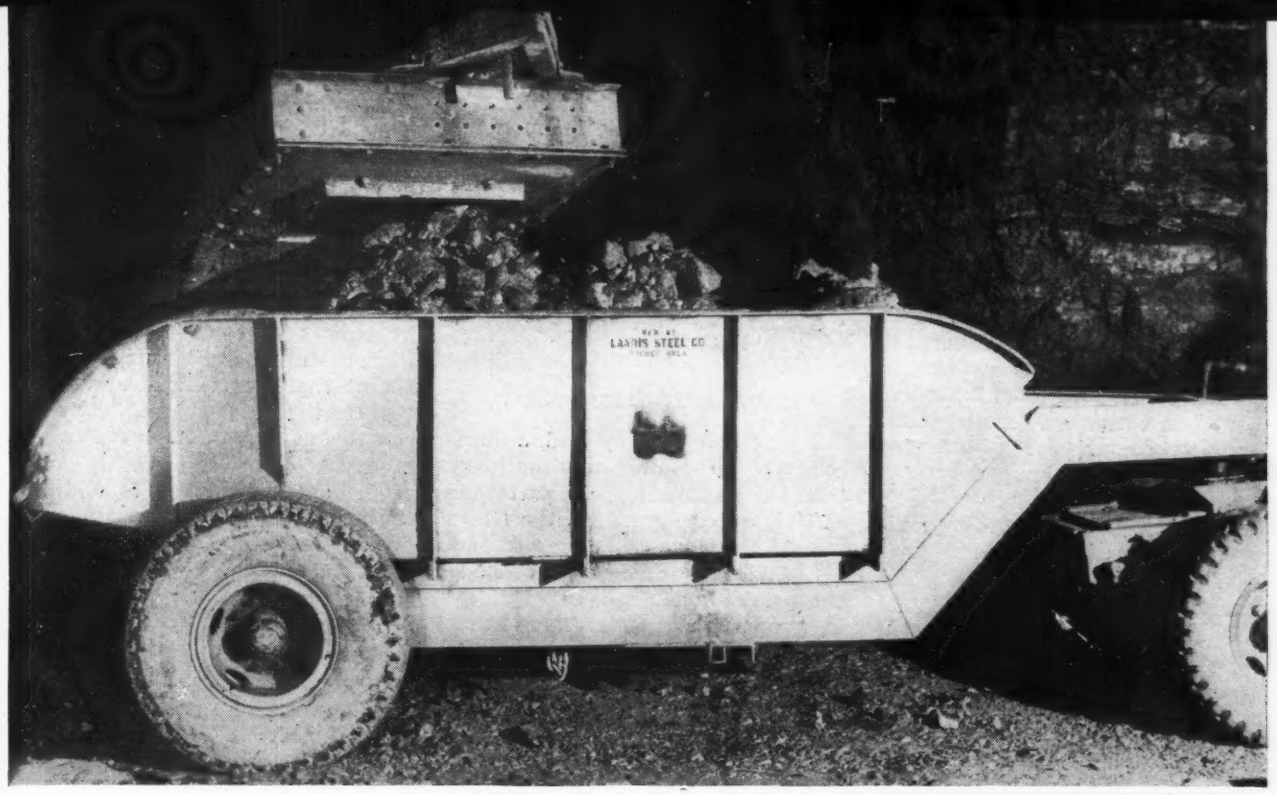
FOR SEVERAL YEARS the staff of Eagle-Picher Mining & Smelting Co. has appreciated that flexibility in operation and certain economic advantages were to be found in the safe application of diesel-powered equipment underground, particularly in ore-hauling trucks. It has, however, been baffled until recently by the problem of control of detoxification of the injurious gases in the exhaust to a permissible low that would not be harmful to the mine employees. An approach to this problem was made difficult by the fact that one of the states of the Tri-State district, in which Eagle-Picher operates, had a law against the use of internal combustion engines in a mine, this in addition to the prevailing antipathy to their use underground.

The mines of this district use the open-stope or room-and-pillar method of mining, and many hundreds of acres have been mined and several hundred shafts sunk, nearly all of these workings having been opened into each other, so that control of air currents is impossible. Climatic changes, moreover, cause reversal of air currents. In some instances the direction of air flow has been observed to change two or three times in a day. In tunnels or "pull drifts" the problem of control is relatively simple.

Many attempts have been made and are still being made to devise some way of improving the present application of detoxifiers in order to win the universal approval of those vitally interested in reducing hazards to the vanishing point.

Some tests were made with air-scrubbing devices through which the exhaust gases passed. Analyses of the gases showed that the scrubbers reduced the objectionable odors and smoke, but the carbon

**A DIESEL-POWERED TRUCK with a box-type body holding 3½ tons was the first unit tried. Exhaust gases are purified by oxygen.**



**A 10-TON TRAILER of the duckbill type was designed to increase the pay load of the diesel engine.**

monoxide content was not affected. On one particular installation the driver was made extremely ill and tests of his blood showed a dangerous concentration of monoxide. Activated carbon filters were not tested, as we were informed that the filters necessary to handle the volume of gases would be so bulky as to reduce the pay load of the truck; thus, from the standpoint of getting additional tonnage per truck we would be no better off than with the storage-battery truck.

## Convert CO to $CO_2$

After the failure of the scrubber system of gas purification, the line of thought was advanced that if a cheap and safe oxidizing agent could be applied to the exhaust gases, possibly under certain temperature conditions, a reaction would take place that would convert most of the carbon monoxide to carbon dioxide. The oxide remaining unchanged would be of such small amount as to be classed as a permissible low.

The first experiments began by introducing compressed air into the exhaust manifold. This manifold was built of sheet steel in the form of an inclosed spiral, resembling a snail shell. Several electric heating units had been placed in the manifold to increase the temperature, or at least to counteract any cooling effect that the compressed air would produce, and also to determine the critical temperature necessary for a favorable reaction. These tests were not at all successful, but they led to the idea of using oxygen instead of compressed air. A standard 244-cu.ft. oxygen bottle was set up, with a reducing valve between the tank and a small manifold. Small tubes led from the oxygen manifold into the engine-exhaust manifold. The tubes extended into the manifold about an inch. Analyses of the exhaust gases showed a decided drop in carbon monoxide content as compared with analyses of the exhaust without introduced oxygen. Repeated tests continued to show a definite difference in the monoxide content after the addition of oxygen (patent applied for).

With these encouraging results, it was decided that the tests should be continued using a modern diesel engine instead of the antique that was first used. The Central Diesel Engine Co. supplied a new HB-400 Cummins engine for further tests. Average analyses of the exhaust gas gave the results in Table I.

A second series of tests on a diesel engine resulted as shown in Table II. The satisfactory outcome led to a decision to install a diesel truck equipped with the oxygen apparatus in the Paxson mine in order to check the test results against underground operating conditions. The U. S. Bureau of Mines was requested to send an

**Table I**

| Conditions | Sample Number | % CO | % $CO_2$ | % $O_2$ | Oxygen Added |
|---|---|---|---|---|---|
| Before treatment | 1 | 0.09 | 2.90 | 16.70 | No |
| After treatment | 2 | 0.06 | 3.85 | 15.45 | No |
| After treatment | 3 | 0.03 | 3.45 | 16.30 | Yes |
| After treatment | 4 | 0.01 | 3.15 | 16.85 | Yes |
| After treatment | 5 | 0.03 | 2.50 | 18.55 | Yes |

This table shows the results of tests on a semi-diesel, or hot-tube-ignited, oil-burning engine. The temperature was raised by means of electric heating coils without addition of oxygen in the cases indicated.

**Table II**

| Conditions | Sample Number | % CO | % $CO_2$ | % $O_2$ | Oxygen Added |
|---|---|---|---|---|---|
| Before treatment | 1 | 0.025<br>0.025 | 6.75 | 11.35 | No |
| Before treatment | 2 | 0.036<br>? | 3.10 | 9.60 | No |
| After treatment | 3 | ?<br>0.006 | 3.00 | 10.40 | 1.4 cfm. |
| After treatment | 4 | 0.007<br>0.007 | 7.35 | 11.30 | 1.4 cfm. |
| Before treatment | 5 | ?<br>? | 5.30 | 13.65 | No |
| After treatment | 6 | 0.011<br>? | 4.15 | 15.95 | 1.8 cfm. |
| Before treatment | 7 | 0.026<br>0.02 | 6.10 | 12.30 | No |
| After treatment | 8 | 0.016<br>0.016 | 5.90 | 13.10 | 1.4 cfm. |
| After treatment | 9 | 0.017<br>0.008 | 5.50 | 13.70 | 1.4 cfm. |
| After treatment | 10 | 0.022<br>0.016 | 5.35 | 13.90 | 1.5 cfm. |
| Before treatment | 11 | 0.064<br>0.064 | 2.70 | 17.20 | No |

This table shows results obtained from tests on a diesel engine. In some instances, as indicated by the question marks, the presence of carbon monoxide in the exhaust gases was not detected by analysis, although it is believed that traces were present.

engineer to sample mine air. The states of Oklahoma and Kansas were also asked to send observers.

The Dart Truck Co. was commissioned to build a truck to specifications designed to permit it to be lowered in a 6x6-ft. shaft, without too much dismantling, and to pass under our standard slusher loading ramps. The truck was to be powered by a diesel unit similar to the one furnished for the tests.

For trial purposes a box-type body with an end-dump door was fitted to the truck chassis. The body had a capacity of approximately 3½ tons, but this load was not sufficient to enable the motor to perform at its best efficiency. In the meantime, analyses of mine air showed a permissible low in carbon monoxide, and frequent tests made of the driver's blood showed absence of monoxide. These results proved that the diesel could be used safely.

**Table III. Analyses of Air Samples Taken During Loading Period**

U. S. Bureau of Mines*

| Location | CO% | Oxides of Nitrogen P.P.M. |
|---|---|---|
| **Engine Idling** | | |
| Breathing zone of drag operator | 0.00 | 0 |
| Breathing zone of truck driver | 0.00 | 2 |
| Engine exhaust—18 in. inside exhaust | 0.02 | 42 |
| **Starting—Full Throttle** | | |
| Breathing zone of driver | 0.00 | 6 |
| Engine exhaust—18 in. inside exhaust | 0.04 | 53 |
| Exhaust stream—36 in. from end of exhaust | 0.00 | 0 |
| **Operating Speed** | | |
| Breathing zone of driver | 0.00 | 9 |
| Engine exhaust—18 in. inside exhaust | 0.10 | 80 |
| **Unloading Period—Engine Idling** | | |
| Breathing zone of grizzly machine | 0.00 | 0 |
| Breathing zone of driver | 0.00 | 27 |

* Data taken from U.S.B.M. report titled "Observations of Diesel-Powered Trucks."

**Table IV. Truck Operating Data**

| Capacity | 8-hr. Shifts Operated |
|---|---|
| No. 1 truck 3½ tons | 311 |
| No. 2 truck 10 tons | 55 |
| Total | 366 |
| Rock tons hauled | 123,436 |
| Daily average per truck | 337 |
| Mileage driven | 5,856 |
| Approximate distance of round trip | ½ mile |
| Average daily mileage per truck | 16 |
| Round trips per day | 30 to 35 |
| Fuel oil per truck per day | 5 gal. plus |
| Drivers' wages | $8.53 per shift, 40-hr. week, time-and-half for over 40 hours. |

| Costs | Total | Per Ton |
|---|---|---|
| Labor—operating, bonus and insurance | $5,721.13 | |
| Lubricating oil | 36.26 | |
| Fuel oil | 171.75 | |
| Oxygen | 990.60 | |
| Repairs and supplies | 1,178.32 | |
| Tires and tubes | 131.00 | |
| Trailer repairs | 219.94 | |
| Total direct charges | $8,449.00 | $0.0684 |
| Depreciation at 25% per year | 1,970.00 | |
| Loss incurred in changing truck bodies | 750.00 | |
| Total | $11,169.00 | $0.0904 |

## Pay Load Increased

To increase the pay load, a duckbill type of trailer was built by the Landis Steel Co., patterned after a type designed for the Netta mine, only larger, having a capacity of 10 tons. This type of body has proved much more economical in maintenance costs than either the end-dump box type or the bottom-drop trailer in use in other Eagle-Picher mines.

One truck has been in operation for a year. The second unit was placed in operation in mid-October of 1946. Operating data on the trucks are tabulated elsewhere.

Repairs were unusually high, owing to trouble incurred in driving one truck from Kansas City, Mo., to the mines. Also, some damage was done in dismantling the units for lowering into the mine. Future installations will avoid these mistakes.

The Paxson mine is in a sheet-ground orebody. Four shafts are in the excavated area. The thickness of the orebody varies from 10 to 18 ft., averaging about 15 ft. Natural ventilation during most of the year is ample to give pure mine air. During extreme hot weather a surface blower is put in operation, sending about 30,000 cfm. down the Swalley shaft. Underground, a booster blower is located at a quiescent place in the air stream to maintain velocity.

On the basis of the results of air analyses by the Bureau of Mines (see Table III), the air hygiene engineer of the Tri-State Ore Producers Association, and the air hygiene engineer of the Eagle-Picher Mining & Smelting Co., we believe that the use of diesels under the conditions portrayed offer no hazard to the men employed in the mine.

The specifications of the diesel engines now in use are as follows:

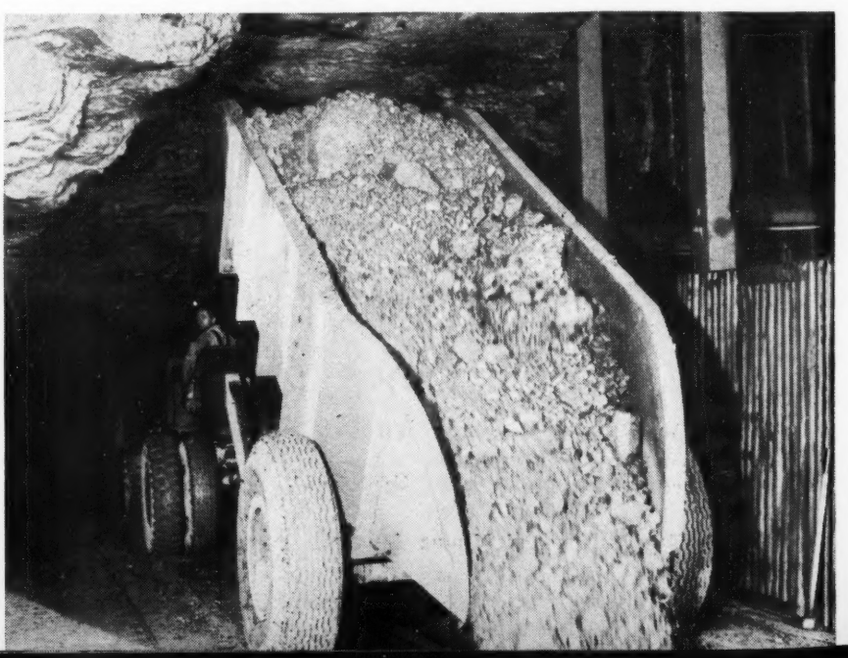
| | |
|---|---|
| Number of cylinders | 4 |
| Cylinder bore | 4⅞ in. |
| Cylinder stroke | 6 in. |
| Piston displacement | 448 cu.in. |
| Rated horsepower | 100 |
| Developed horsepower | 70 |
| Maximum rated speed, r.p.m. | 1,800 |

The fuel oil used is a neutral, distillate petroleum oil of the following specifications:

| | |
|---|---|
| Specific gravity | 37.4 A.P.I. |
| Sulphur content | 0.177% |
| Viscosity (Saybolt) | 37.2 sec. at 130 deg.F. |
| Cetane number | 53 |

Acknowledgment is made to Messrs. Fred Netzeband and Burr Aton, air hygiene engineers with the Tri-State Ore Producers Association and the Eagle-Picher Mining & Smelting Co., respectively, for their laboratory work and many helpful suggestions; also to many members of the U. S. Bureau of Mines and of the mining and safety departments of the states of Kansas and Oklahoma for their cooperation.

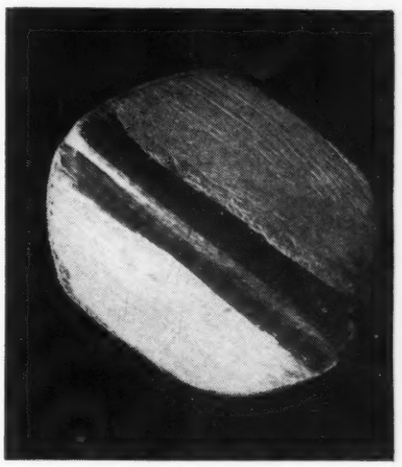
**THE DUCKBILL-TYPE TRAILER** is shown discharging a 10-ton load of ore. This unit averages more than 30 round trips a day and has proved economical in operation.



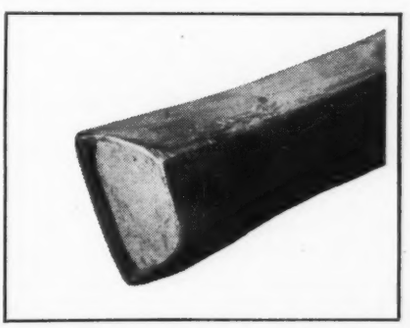
# Tungsten Carbide Promises Faster, Cheaper Drilling

**R. G. SULLIVAN,** Research Engineer, United States Vanadium Corporation, Henderson, Nev.

**Tests made with two-point and four-point rock-drill bits, in which the cutting edge is supplied by inserts of tungsten carbide, indicate that they surpass standard detachable bits both in drilling speed and in use-life, with reduced requirements as to labor and air. The smaller, more durable, faster-cutting bit is used in smaller, lighter drills requiring less labor of handling. Design and development of new rock drills built to take advantage of the drilling qualities of tungsten carbide are anticipated. The collaboration of several prominent companies is reported.**



**FACE of a new chisel-type carbide bit, with cutting edge provided by tungsten-carbide insert. The insert is 1 22/64 in. long, 11/32 in. wide, and 5/8 in. high. The photograph just below shows the bit in side view. The insert of this Coromant bit contains approximately 90% tungsten and 10% cobalt, and is welded in the steel by copper**

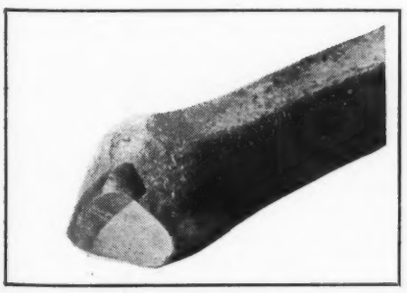


RUMORS of the development in Europe of a new rock-drilling bit last February led the United States Vanadium Corporation to investigate this new tool for use in its Western mines.

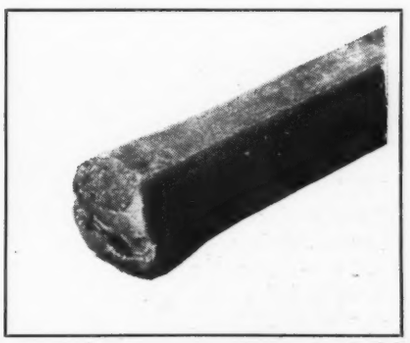
Purchases were made of some of the conventional tungsten-carbide rock bits then being offered for sale, and tests were instituted in two of its mines, at Rifle, Colo., and Bishop, Calif., respectively. These tests extended on into the summer and fall of 1946. They were broadened to include many of the products being experimented with by domestic tungsten-carbide producers in conjunction with some of the rock-drill manufacturers. The preliminary results of these tests will be covered in a general way in this article.

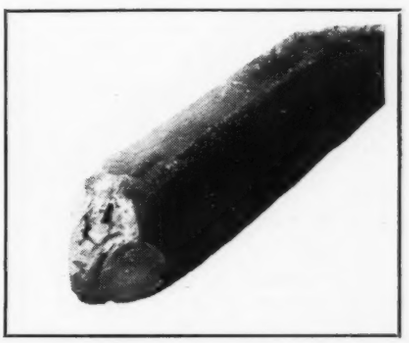
About ten years ago, the Germans first investigated the use of sintered tungsten carbide in equipping air drills with hard-metal cutting edges. In this country, work had started to solve the same problem with welded hard-metal surfaces. Neither attack was successful, in part because the brittle and hard metal cutting edges were shattered by the heavy drilling equipment. Further research on the physical properties of sintered tungsten carbide developed means of increasing the toughness, and this product was used with light drills. One of the first successful applications of tungsten carbide with a matrix of cobalt was demonstrated in 1939 at the Friedlicher and Dansenbaum mines in Germany; using a small bit of 48-mm. gage, in hard conglomeratic sandstone, from 140 to 180 meters of drill hole were obtained per bit.

In the years just before the war little interest was evinced in the new tool in countries outside the



**AFTER RECONDITIONING by grinding, the chisel bit looks thus. Note the dullness of the corners**





**USED TO DESTRUCTION, these two chisel-type carbide bits are in the condition shown**

Axis powers. In 1942 the Sandvik Steel Works Co., in central Sweden, conducted exhaustive tests in its laboratories and iron mines. As a result, the company introduced its "Coromant" line of drills[1], which were used extensively in Sweden and Norway, but did not become available in the United States until after the war. This Swedish product is employed in light air drills which strike a very rapid blow. Its successful use is probably due to the fact that the drill was adjusted to the best qualities of the bit.

## Domestic Development Held Up by War

At about the same time that the Swedish concerns began their research into rock drilling with carbides, some leading domestic carbide producers started development in the United States. The development here, however, was held up during the war.

Russia has used this type of bit in its mines for several years, a fact that was reflected in its large purchases during the war from American producers of the tungsten-carbide slugs or inserts. In other foreign countries, various interesting stories could be told respecting the use of this tool. Great interest has been aroused particularly on the Rand, in South Africa.

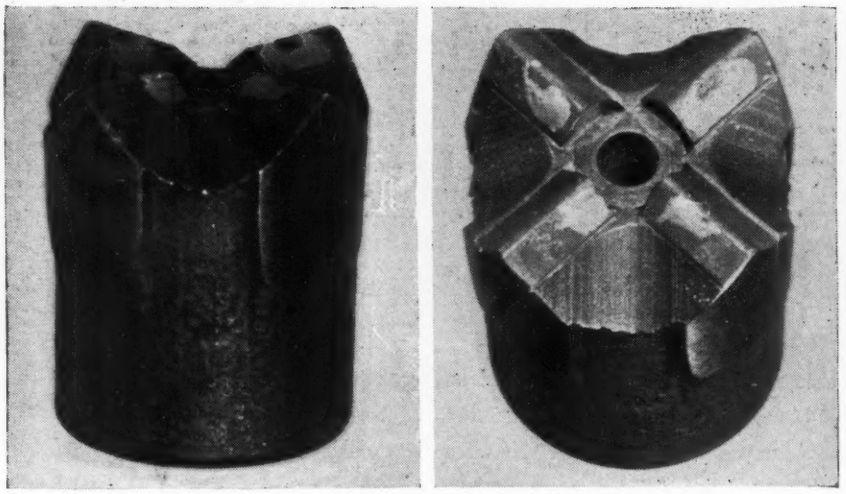
## The Chisel-Type Bit

The carbide bits being offered and tested at present are of two general types—the chisel, or two-point, type and the four-point bit.

The first is to be seen in the Coromant drill, already mentioned, in which the tungsten carbide is inserted in the end of the steel which has been forged to have a chisel edge. This type may be procured in either $\frac{7}{8}$-in. or 1-in. hollow-hexagon steel, in bit sizes ranging from approximately 1.42 in. to 1.14 in. Obviously, there are no problems of threads or attachment.

This chisel-type two-point bit was developed for use in small, light and fast-hitting jackhammers and stopers. The rocks in which it is being used in Sweden include leptite, magnetite, and granite. An air pressure of 70 psi. (pounds per square inch) is usually maintained at the drill. This type was used because it is easy to make, simple to recondition, and because the chisel shape is superior to most other shapes in respect to drilling speed and power requirements. The blow or flushing hole is on the side.

[1] "Rock Drilling with Hard Metal Drills," by C. A. Widen, "Teknisk Tidskrift," Stockholm, Vol. 75, May 12, 1945.



**A FOUR-POINT CARBIDE BIT, when new, seen in side and face views respectively. Note the tungsten-carbide inserts which are brazed to the steel stock to form the cutting edges. This is a detachable Ingersoll-Rand-Carboloy Series 13C Jackbit**

Tests made with the chisel-type bit by the United States Vanadium Corporation in medium-hard, abrasive sandstone indicate an average life expectancy of 350 to 500 ft. This may be compared with a normal life of 6 ft. per detachable (steel) bit-use with a total average life of five uses, or 30 ft. Reconditioning of the Coromant bit is usually not required. Gage loss does not exceed $\frac{1}{8}$ in. over the entire life, while steel bits lose approximately $\frac{1}{16}$ to $\frac{1}{8}$ in. per use.

As the bit diameters varied from such small size as 1 22/64 in. for starters to 1 17/64 in. on fourth changes, as compared with the approximately 2-in. diameter of the conventional four-point detachable bits, most of the rock drills used were found to be too powerful for successful work. Penetration of the rock by the chisel bit when used with a heavy machine usually was too fast. With the smallest stoper available, successful drilling was obtained at a rate of approximately $2\frac{1}{2}$ fpm. This rate was virtually uniform until the bit was destroyed. More even performance was noted after the bit was partially dulled.

## Detachable Bit Compared

The standard detachable bit gave uniform drilling speed for one-half of its use-life, after which the rate was retarded geometrically as the gage wear increased. Average drilling speed of this type of bit was 15 in. per minute.

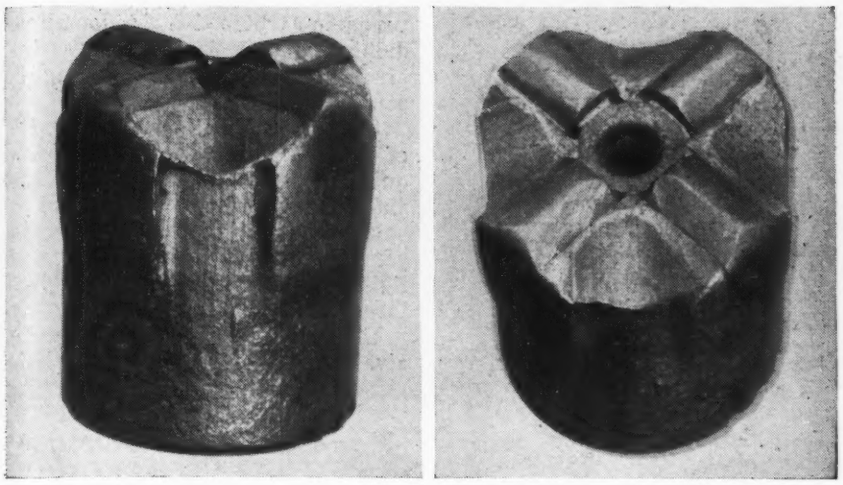
For further comparison in this type of rock, a mounted jackhammer was run against a standard 3-in. drifter. Each was set up on a crossarm and column. Carbide bits were used in the jackhammer, the larger machine being considered too heavy for them. Fifty percent greater speed was obtained with the carbide bit.

## Tested in Harder Rock

Following these impressive results obtained at Rifle, Colo., by U. S. Vanadium, further tests were carried on at its Pine Creek mine, near Bishop, Calif. Here the average rock was much harder, consisting chiefly of granodiorite, tactite, and a highly metamorphosed limestone, sometime locally called a silicified lime. Here, it is estimated, detachable bits drilled between 1 ft. and 2 ft. per use for a total life of five uses. The footages in the granodiorite varied between 2 and 4 ft. per use, in the tactite between 1 ft. and 3 ft., and the hardest phases of silicified lime sometimes demanded a new bit for every 1 to 4 in. of hole drilled.

The machines used with the carbide bits were the smaller, lighter stopers and jackhammers that currently are in common use. The jackhammers included the mounted and hand-held types, the latter being used dry in open-pit mining. The piston diameter of the drills varied between $2\frac{3}{8}$ and $2\frac{3}{4}$ in.

Results of the tests gave an average drilling life of 81.7 ft. with five reconditioning regrinds per bit. Regrinding was necessary every 5 to 20 ft. because of the reduction in drilling speed experienced when the



AFTER DRILLING 60 ft. of hard silicified limestone, the new four-point bit shown in the pictures on the page opposite is now seen to have become considerably dulled

bits were used with the less powerful machines. This figure varied directly with the hardness of the rock, but was determined in all cases when the drilling rate dropped to 66% of the original speed.

## Reconditioning Near Face

Regrinding of the chisel-shaped bit is simple and is done at or near the working face with a portable air grinder. Silicon-carbide wheels of 40 to 60 mesh are necessary. Reconditioning is completed with a short honing by hand to remove grind marks and rough edges. The carbide is not ground to a sharp point but is brought back to a fairly blunt tool having a point of approximately $\frac{1}{8}$ in. across the cutting edge The whole operation may require between 2 and 5 minutes.

From the average footage figure it is ascertained that we got 81.7 to 40.8 times the footage obtained with an average steel detachable bit. In the hardest silicified lime, footages of 40 ft. per bit-life were common, and this translated into an equivalent number of detachable-bit uses gave us a ratio of 120–480 to 1. In the medium-hard granite, this ratio was reduced to 40–60 to 1.

Many tests were made to compare the drilling speed obtained with the light drills using tungsten-carbide bits with that obtained with the heavier 3½ in. and 3-in. drifters using standard 2-in. detachable bits. In every instance the smaller machine using the small carbide bit drilled between two and three times as fast. This decrease in drilling time was more marked in the harder rock, where the steel bit becomes dulled after a comparatively few inches of penetration.

## The Four-Point Bit

The second general type of carbide bit tested was the four-point bit manufactured and developed by Ingersoll-Rand Co. with the Carboloy Co. and the Allegheny Ludlum Steel Co. in conjunction with the Sullivan Division of the Joy Manufacturing Co. The Chicago Pneumatic Tool Co., Firth Sterling Steel Co., Haynes Stellite Co., Kennametal, Inc., and others were very helpful and cooperative. Their advice and suggestions as to some of the test equipment and carbide products helped facilitate the conduct of the entire program.

The testing of these four-point bits has been carried on at U. S. Vanadium's Pine Creek Unit. The program is still under way, and the data used here pertain only to a preliminary stage of the development. The bits used have each had four small carbide inserts brazed to the steel stock to form the gage and cutting edges. All of them have been 1½ in. in gage diameter.

## Two Ways of Attaching Four-Point Bit

This four-point bit is of two types with respect to the manner of attachment. One is a detachable type having a special threaded coupling, and in general it looks like the standard detachable rock bit. The other type is made in lengths of drill steel suitable for the application of the Linde Air Products Co.'s pressure-welding process. The length of the bit is usually 7½ to 12 in. and the bit is pressure-welded to the rod to form a solid connection. Both types of connection have their advantages in certain applications, as will be brought out in the subsequent discussion.

The four-point shape was chosen for testing because most manufacturers thought it would make it possible to overcome many objections that have been raised in the past over the use of chisel bits. It was realized that the four-point bit would require more power and a larger machine, and, because of the use of a larger machine, heavier steel and larger bits would be necessary.

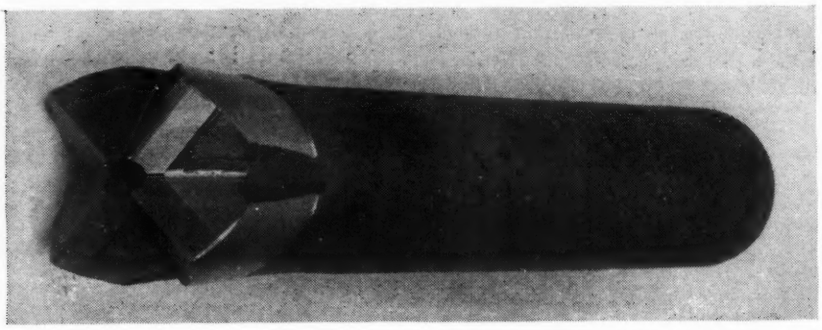
Drills used in these tests were standard Ingersoll-Rand 3½ and 3-in. drifters, 2⅝-in. jackhammers, and 2⅝-in. stopers. Steel for the drifters was 1¼-in. hollow-round lug shank and 1-in hollow-hexagon for the jackhammers and stopers. The threaded Jackrods used with the detachable type were made of a high nickel-chrome alloy drill steel, and the steel used for pressure-welded application was high-carbon steel.

## Superior Results

Results obtained in drilling all formations in the mine indicated an average life expectancy of 67 to 78 ft. per bit. The ratio of life of the carbide bit to the steel bit varies between 76 to 1 and 35 to 1. The speed of penetration of the carbide bit in comparison with that of a regular detachable bit is almost in direct proportion to the area of hole drilled, the diameter being 1½ in. in the case of the carbide bit and 2 in. for the standard bit. Where the drilling speed of a carbide bit is compared with that of a steel bit of the same diameter, the speed of the former is well sustained through the depth of the hole, whereas that of the steel bit decreases with gage wear. An average increase in speed of 35 to 50% can be expected for the life of the carbide bit over that of an ordinary bit.

The four-point bit does not require to be resharpened or reconditioned in any manner. After drilling 10 to 15 ft. it may appear dull, but the loss in speed is only a small fraction of the starting rate. In cases where this has been measured, the loss has appeared to be as much as 10% of the initial cutting rate. These rates apply only when used with the more powerful machines.

Loss in gage over-all has never exceeded $\frac{3}{32}$ in. and rarely has been in excess of $\frac{1}{8}$ in. This has permitted the use of bits of the same diameter throughout the length of standard 16-ft. jackhammer holes. Use of a bit of the same size for



**PRESSURE WELDING is used for attaching this new four-point bit, which is of Allegheny-Ludlum-Joy make. Note that the cutting edge is a flat surface of appreciable width**

both starting and finishing is standard practice.

As previously noted in the tests with the Swedish bit, the best results comparatively were obtained in the hardest rocks. It is in the extremely hard formations that tungsten carbide best demonstrates its merit. If used in softer rocks, the machine size must be reduced greatly or premature breakage will result, due to over-penetration and the insert twisting out.

## Pressure Welding Solves Attachment Problem

To return to the problem of joining rods and bits, it was apparent early in the work of testing bits that attachment devices, when used under continuous drilling, give much trouble. Because of the many failures it was thought that some type of permanent joint might be advisable. Pressure welding appeared attractive, and experiments were conducted to obtain a connection by that means, which would have a life equal to or greater than that of the bit. The job of preparation and welding is comparatively simple, requiring approximately 10 minutes of one man's time. Welded joints have successfully withstood the hardest usage for several times the required footage, and appear at this time to be a very satisfactory answer.

Pressure welding, as now practiced at Pine Creek, is used to attach both the bits and shanks to the drill rods. It is also employed as an additional tool in reclaiming broken and shanked drill steel. The end of the steel is prepared for welding by cutting it off with a regular cut-off saw and grinding the face normal to the axis of the steel, to a polished surface. Both pieces of steel to be welded are clamped in hydraulic jaws of the welding machine. The two polished faces are pressed together at an initial pressure of approximately 2,000 psi. and the joint is heated with a circular Oxyloacetylene torch until the two pieces are raised above the critical temperature. As soon as upset starts at the joint, additional pressure is applied up to approximately 4,000 psi. and the steel is upset for a total linear distance of one-half its diameter. The weld is allowed to cool and the upset portion is ground down to the original steel size. The water hole has a tendency to enlarge so that no trouble is experienced in blocking the passage. This type of welding requires no forging, fluxing or additional metal.

## Threads Desirable

As the use of threads or some detachable connection is necessary to make full use of the qualities of a tungsten-carbide bit in long-hole drilling, the development of the Ingersoll-Rand detachable coupling is continuing.

Use of carbide bits offers promise of faster drilling with reduced requirements as to labor and air. This should result from the use of a small, durable, fast-cutting bit in combination with smaller and lighter machines requiring less labor of handling.

Use of smaller-diameter explosive charges of higher strength is also being tested.

## May Cause Drill Changes

The qualities of the new cutting bit are expected to result in the design and development of new rock drills built to take advantage of the drilling qualities of tungsten carbide. These machines could be adapted to gang drilling, taking advantage of the small gage loss to permit steel changes of 8 ft. or more.

We anticipate the use of bits with gage sizes down to $\frac{1}{2}$ in. which would be especially useful in blockholing. This will probably be accomplished by very light-weight, hand-held jackhammers.

The principal objective in the development of this new drilling tool is to reduce the amount of labor required in rock drilling, thus making the job of drilling more attractive and better paid so as to attract skilled labor.

# Record Drill Hole Proves to Be Electric Ray

THE FEAT of drilling a hole 20 miles deep in two days was attributed to the Russians in a news item recently carried in the *New York Times* and other newspapers. An investigation of the facts behind this report produced the following explanation:

Since before the war Prof. A. P. Krayev and researchers, of Leningrad University, have been experimenting with electrical methods of probing deep into the earth's crust. After several years' interruption, work was resumed in 1946 in the vicinity of Leningrad, and with the aid of special geophysical equipment a depth of 20 to 25 miles is said to have been penetrated in one to two days, producing valuable data and proving the practical significance of the method. Neither apparatus nor the technique is described in detail.

"World science has no record of such a depth being reached by electrical sounding," Prof. B. N. Yanovsky, of Leningrad University, told the press. "Until now the earth's crust has been studied only to a depth of three to five kilometers. We know of only one instance when a French scientist reached the depth of seven and a half miles. Yet the greater our knowledge of the earth's crust, the better we can judge of the minerals it contains." Mechanical drilling to such a depth, he noted, even if technically feasible, would take several years and involve a tremendous outlay of money and materials.

Electrical methods of geophysical exploration in use in the United States are confined to generally shallow depths. The reflection seismic method, commonly used in deep determinations, has proved accurate in mapping oil structures to depths of 15,000 ft.

# Public Necessity Abrogates the Right to Strike

**E. S. TILLINGHAST,** East Hampton, N. Y.

**The opinions voiced by Mr. Tillinghast in this article, and in others he has written for *E. & M. J.*, are based upon more than casual acquaintance with labor problems. He retired only recently from the position he held for many years as mine superintendent of the Hill-Annex pit of Inter-State Iron Co., a Mesabi Range subsidiary of Jones & Laughlin Steel Corp.**

MAN POSSESSES NO RIGHT that is given to him entirely, unconditionally, or uncircumscribed, not even those fundamental ones "guaranteed" by our Constitution. I have the right to live, yes; but only so long as I do not injure or destroy the life of my fellow man. I have the right to liberty, as long as none of my actions impinges on the liberty of others. I am granted the right to pursue happiness, elusive as it is, if the chase does not lead me to trespass on the happiness of my neighbors.

When our country was young and sparsely settled, the impact of man on man was felt but little. The individual citizen could assume many privileges that a more congested population could not tolerate. He could carry his gun anywhere without interference; there were no zoning laws to tell him where he might build, or speed limits to prevent him from riding his horse as fast as the animal could go; he could make his own strong liquor and dispense it without fear of revenue officers.

## Rights Are Limited

But as the population multiplied and expanded, these and many other liberties that men had taken for granted were gradually withdrawn. They were rescinded, not because human nature had changed, but because the exercise of these "rights" which a widely scattered society could permit its members, encroached on the rights of others.

The "right" to strike, whether the strike be "wildcat" or planned, has also passed into the zone where it can no longer be exercised in many cases without definite infringement on the rights of thousands of other citizens. With men organized into unions numbering hundreds of thousands, all under the control of one or a few leaders, their power over our economy is almost unlimited.

When the organized workers of the nation's basic industries quit their jobs *en masse*, this action becomes a threat to the nation's industrial life and to the well-being of millions of its workers. No other "right" which adversely affects so many people has remained unrestricted. There seems no apparent reason why the right to strike should continue immune from restraints similar to those which society has imposed on others to protect the welfare of the majority.

If the demands of a union are just and reasonable, as they often are, it may rely on public opinion to support them. If the union's demands do not receive public indorsement, but are "bulled through" because the union is strong enough to extort them, that union has lost something which a few-cents-an-hour increase in pay cannot restore.

Many union men firmly believe that the recent display of despotic control over a large number of workers in the coal fields has done the cause of labor more real harm than all the "labor baiters'' of press or politics could ever inflict. That strike imposed inconvenience and severe hardship on many times the number of people directly involved in it, and it may result in permanently repressive measures that are unjust to all labor and undeserved by an overwhelming majority of union members. Retaliatory laws, enacted under the goad of an outraged public opinion, are unlikely to be considered with the thoughtful objectivity they should receive.

## Arbitration Approved

We have arrived at a point in our industrial civilization where, for the common good, large-scale strikes in basic industries should be renounced. Unions in such industries should be prevented from striking on a nation-wide basis, or these industries should be compelled to accept arbitration of disputes that cannot be settled by collective bargaining.

Labor would not be injured but benefited if it accepts this method of settling its disputes after having exhausted the possibilities of collective bargaining, just as was the individual when he could no longer go armed in order to settle his personal quarrels by force. Many a worker will not recover during the remaining years of his active life what he has lost from many weeks of idleness through strikes, in some of which he had no direct concern.

A strike settles but one thing: which side can hold out the longer, not the right or justice of the issue. Public opinion is a far safer and saner arbiter, and it leaves behind fewer unhealed wounds.

If our civilization has not advanced to the point where we may decide our industrial disagreements deliberately and peacefully by honest collective bargaining or by arbitration, we have learned little from thousands of years of struggle toward a better life for the majority.

# Brazilian Excursion

**R. H. RAMSEY,** Associate Editor

AIR TRAVEL has now reached a point where you can be snatched from one side of the world to another so swiftly that reality never catches up with you. Especially if you take off, as I did, from New York one Sunday morning, fly down across Puerto Rico, Trinidad, the Guianas, the sponge-like islands and broad reaches of the Amazon, the tangled rocky wildness of Brazil, and wind up all out of breath on Monday afternoon in a Hollywood dream-castle of a hotel perched on a mountain about 30 miles outside of Rio de Janeiro. All I could think of was, "Gosh!"

This hotel, the Quitandinha, preserved the unreality set up by the airplane trip. Three years ago, Vargas, Brazil's ex-dictator, gave Dorothy Draper, a Hollywood decorator and designer, a free hand and about $15,000,000 to make it the world's most magnificent resort hotel and gambling casino. And that the Quitandinha certainly is, or, rather, it would be if Vargas had not been deposed and his successor, Eurico Dutra, had not outlawed gambling. Now the black cloths cover the gambling tables and only a handful of guests wander about its luxurious halls, swim in its marble pools, or dance in the splendor of its night clubs.

In this lush display of color and contour, it was asking a lot to expect the delegates to the Second Annual Pan American Congress of Mining and Geology to sit down soberly and consider economics, paleontology, and flotation reagents, but we did. For a whole week we kept our minds more or less on business despite the utter incongruity of our plushy surroundings. (See *E&MJ*, Nov. 1946, p. 71.)

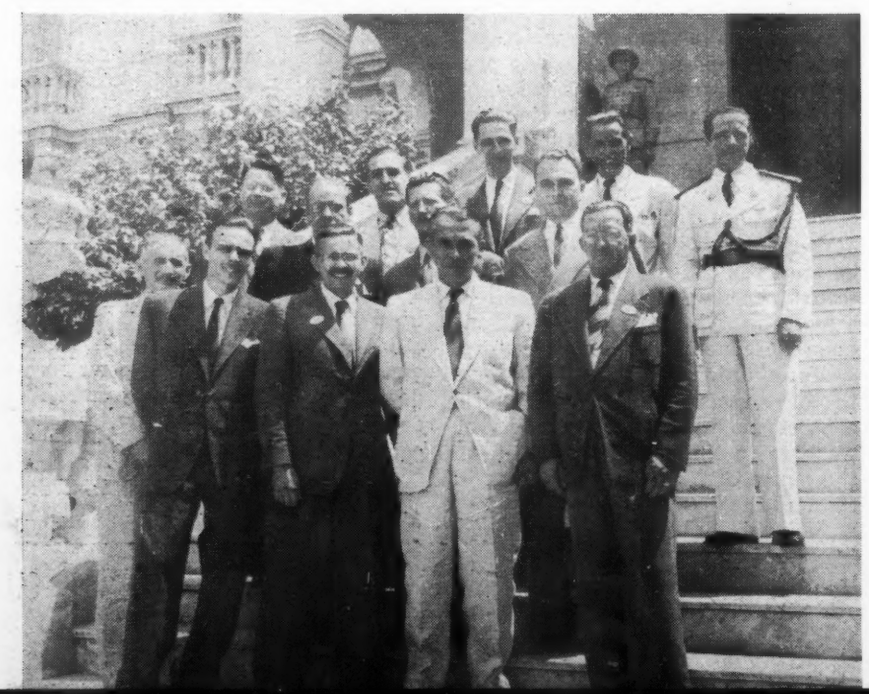
Thus, it was with a feeling of relaxation that I left the Quitandinha and its distractions to set out with some 40 other *Congresistas* on one of the special tours the Brazilian section had arranged for us. (See *E&MJ*, Dec. 1946, p. 86.) We left Rio by plane for Victoria, whence we were to travel by special train up the Rio Doce to Itabira, the famous iron orebody, on through the charcoal iron blast-furnace country, around through Belo Horizonte to the Morro Velho gold mine and Ouro Preto, and so on back to Rio. Right here I want to thank our Brazilian hosts publicly for this trip. I had the time of my life.

On the way to Victoria I met Harvey Hakala and Jim Hustad, both Oliver Iron Mining Co. engineers from Duluth, who were the only other United States delegates in the party. The three of us began the trip inauspiciously by getting ourselves marooned at the Victoria airport and having to be sent for by special car. It wasn't the last time either.

In Victoria, we met the Governor of Espirito Santo, inspected the iron-ore loading docks, took a splashy but lively launch trip around the beautiful blue harbor, and left that evening. Our narrow-gage special train included three sleeping cars, a well-stocked diner, a coach, a baggage car, and a wood-burning locomotive, and we chugged out of Victoria leaving a trail of sparks like a skyrocket.

We spent next day visiting the mica mines near Gobernador Valadares, a district that helped most effectively in the war effort. Mining for mica seems to involve a mole-like process of drifting around in pegmatite until you find some, but the men must develop a nose for "pay," judging by the stockpile of mica "books" that we saw. Here Hakala, Hustad, and Ramsey got interested in hunting for topaz and tourmaline and were marooned again 30 km. out of town, but this time we had Senhor and Senhora Lott along. He was the tour's director, so they *had* to send a car back out for us.

**EXCURSION GROUP meets Sr. Aristides Campos, Governor of Espirito Santo, which includes town of Victoria. Governor is in white suit. To his right is Dr. Otavio Barbosa, São Paulo mineralogist; to his left, Dr. Hermano Lott, director of technical school, Belo Horizonte. Harvey Hakala is at left end, Jim Hustad at right end, of second row.**



## Disappointment at Caue

We awoke next day in Presidente Vargas, the town at the foot of Caue Peak, that famous mountain of iron ore we have all heard so much about. Unfortunately the practice of the local farmers of burning off the grass and weeds once each year had created a thick haze and we could neither photograph Caue Peak or even see it clearly. We did drive to the mining operations on its top, however. An accompanying table gives pertinent data on current activities.

I was interested to learn that mining on Caue Peak has to be done selectively to get the 68.5% ore for which the Peak is famous. Unselective mining of the mountain would bring down about one-fourth hard ore, carrying plus 65% iron and minus 0.02% phosphorus,

and three-fourths soft *jacutinga*, carrying 48 to 50% iron. The latter would have to be washed and probably sintered to make good furnace feed.

A total of about $19,000,000 has been spent recently (most of it was lent by the Export-Import bank) to modernize mining at Caue Peak, expand the capacity of the 600-km. of narrow-gage railroad down to Victoria, build the ore-loading docks there, and thus make Itabira's ore available to the world at a rate of about 1,500,000 tons annually. The money is spent, yet Itabira is expected to produce only about 200,000 tons of ore in 1947.

## Costs are High

The crushers and conveyor belts by which the ore was to be handled are at the property but not set up. The 50-ton railroad cars can be loaded to only 30 tons because not all the bridges on the line to Victoria were strengthened sufficiently. Only 12 cars can be hauled on the grade down from Itabira, but 30 cars make up a train down on the flats along the river. It takes three or four days to move a car to Victoria. The freight cost from Itabira to Victoria is about $2.90 a ton; freight from Victoria to, say, Sparrows Point, Md., in 9,000-ton ships would be about $8 per ton. Obviously Itabira ore can't be sold in the United States except at a substantial loss.

All of Itabira's production is now confined to plus-½-in., minus-3-in. hard lump hematite, which goes to England. About 110,000 tons was shipped in 1946. The minus-½-in. hematite is discarded. No other contracts could be taken at present because the railroad, as it stood when I saw it, could not carry any more than it now does.

About half of Brazil's present annual consumption of 300,000 tons of steel comes from the charcoal iron blast furnaces of the Cia. Siderurgica Belgo-Mineira at Monlevade, our next stop after leaving Itabira. Monlevade was until recently the only rail mill in South America, a distinction it now shares with Brazil's new national steel plant at Volta Redonda. However, Monlevade is still the only mill that is really rolling rails, because Volta Redonda is not yet much past the steel ingot stage. Started in 1942, Volta Redonda will be producing steel products in quantity some time this year. Its annual capacity will be about 300,000 tons. Monlevade, staffed by Brazilians and Luxembourgers, is obviously a well-run plant. It produces 60-lb. rails, iron wire, reinforcing rods, barbed wire, and nails, with a minimum of lost motion.

We were entertained royally at other charcoal-iron plants, notably Cia. Morro Grande, at Barao de Cocais, and at Jose Brandao, where the Cia Ferro Brasileira produces, among other things, about 50,000 meters a month of centrifugally cast pipe.

After an interlude of luncheons, dinners, and official visits in the truly beautiful city of Belo Horizonte (the name means "beautiful horizon"), we left in buses for Nova Lima, site of the St. John D'el Rey gold mine, where the management kindly arranged to take the whole group of us, 40 or 50 people, through the mine. Hakala, Hustad, and I, and Tomas Leighton, the gentlemanly and capable professor of mining from the University at Santiago, Chile, were for-

## How Iron Is Mined at Caue Peak

**Ore reserves of Itabira region around Caue Peak are now estimated at 250,000,000 tons of plus-65% iron ore, 400,000,000 tons 48% ore.**

**DRILLING—Caue Peak hard, specular hematite is broken in 7-meter benches; 3-in. holes, 4½-meters deep, wagon-drilled 2 to 4 meters apart in row 4 meters back from face. Toe holes are 4½ meters deep. Detachable bits used; starter steel used for 6 ft. in each of three holes; bit changed for next 6 ft. in these holes, hence, 18 ft. per sharpened bit.**

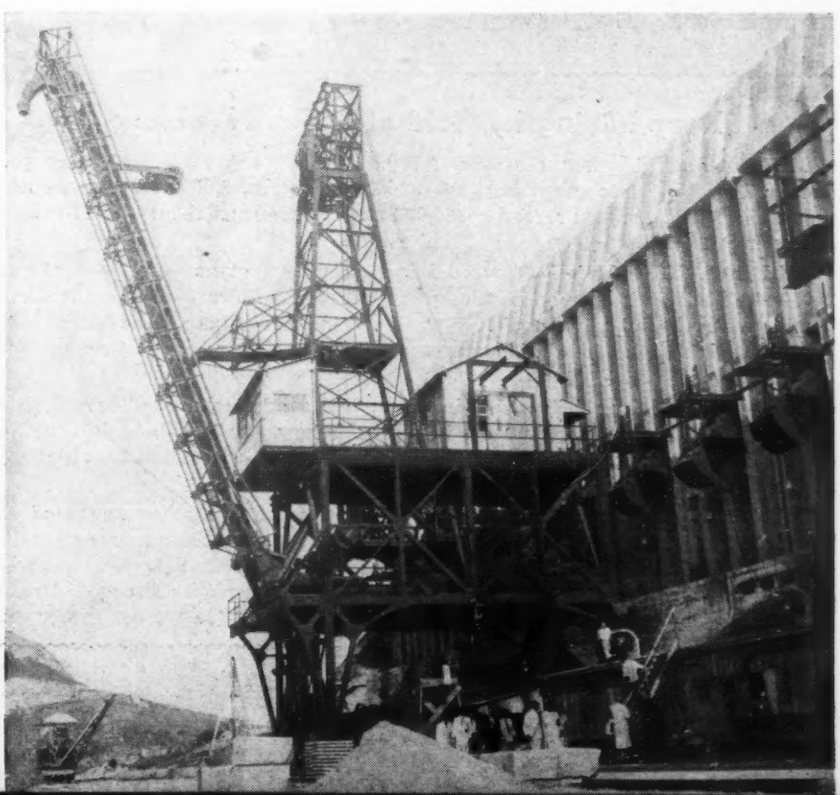
**BLASTING—Holes loaded with 60% gelatine dynamite; 30% overbreak; 0.35 lb. powder per ton broken.**

**CRUSHING—Jackhammer blockholing, or sledgehammers, for large chunks; single-jacks for rocks. Aim is 3-in. lump.**

**HAULAGE—Manure forks to load ore into wooden carts gives rough screening. Undersize discarded. Carts dumped into chutes leading ore to bins for 11-ton trucks. Haul to railroad is 5½ km. down 6% grade. Trucks unloaded by manure forks at railroad because dump bodies not available or missing.**

**LABOR—Mining operation employs 150 men. Average wage is 525 cruzeiros ($28.60) per month. Production is 2.3 to 2.5 tons per man-shift into trucks.**

**IRON ORE LOADING DOCKS at Victoria use two traveling booms like the one shown here, which receive ore from one of 20 bin gates, feed it with pan feeder to 36-in. belt, Weightometer, and belt on boom. Cars from Itabira dump at top of concrete bins. Loading rate for ships (9,000 ton's maximum burden) is 960 to 1,000 tons per hour with both loaders.**



**DRILLING AT 7,350 FT.** in one of lower rill stopes of Morro Velho gold mine, one of world's deepest. Air temperature here was 112 deg. F. Drilling is dry to keep humidity down. Dust is removed by strong ventilation. Surface fill replaces ore broken out.

tunate enough to be taken in tow by A. H. Downe, the underground manager. He took the four of us down through increasing stages of heat until we hit bottom at 7,350 ft. below the collar. Air temperature was 112 deg. F. and humidity was 82 deg. wet bulb. There are workings that go down to 8,050 ft. To maintain this temperature and humidity at that depth, 80,000 cfm. of air is cooled by Carrier air conditioning to 45 deg. F., dried, and blown into the mine. Water in the mine is held to a minimum; all drilling, for example, is dry. Data on the operation appear in an accompanying table.

Because everything is so dry, every precaution must be taken in the company's Morro Velho mine to avoid dust. That is why, we were told, no mechanical loaders or scrapers are used. The mine has a payroll of about 8,500 men. The average daily wage before the war was about ten cruzeiros. It is now forty cruzeiros, about $2.20. Mining and milling costs have about tripled over the same period. Unlike many gold mines, St. John D'el Rey has at least plenty of opportunities to cut costs by mechanizing, if the dust problem can be solved.

We came out of the mine pretty thoroughly baked, and, by way of a special treat, Mr. Downe introduced us to several of the biggest bathtubs we had ever seen, each brimfull of clean warm water, a rare item on this trip. Mr. Downe sat on the edge of his tub and splashed water vigorously in all directions, but the four of us simply submerged completely, coming up only at intervals for air like a hippopotamus. It was wonderful.

The trip wound up with a night and a day in Ouro Preto, (Dark Gold), a fine old mining town, where we visited an aluminum plant and the national school of mining and metallurgy. A friend of Harvey's took us for a tour of the town, and a more beautiful setting for a mining school could not be imagined. The cream-colored houses, with their red-tiled roofs, and all built in the same antique and naturally beautiful style of architecture, are strung up and down the wooded slopes of green hills. The streets are cobblestoned, narrow, and climb at breath-taking angles. The only level stretches are the little *plazas* in front of the many massive old churches, with their carved doorways and stone fountains bearing inscriptions chiseled 300 years ago. Ouro Preto once saw plenty of action when the patriot, Tiradentes, started Brazil's revolution from Portugal there in 1720, but now it is a lazy, very satisfying place where one would like to relax for a while. One could do it in comfort, too, because Ouro Preto has a fine, new, utterly modern hotel, whose severe lines and garish colors in that ancient setting have, however, all the jarring effect of a scream. I was truly sorry to leave Ouro Preto for Rio and end the fun of the trip.

## Good Future Seen

We did not, of course, see all of Brazil's mining centers on this excursion. Other groups went to the diamond placers or to the Santa Caterina coal fields, and there are other more remote districts, such as the Goiaz nickel deposits, where none of us went. However, our trip did cover that part of Brazil's mining country that is currently active. What, then, of the future?

Ordinarily, a country potentially as rich as Brazil would have been gone over thoroughly by prospectors, as the United States has been, but the fact is that there are very few prospectors in Brazil as we know them. For many years Brazil's mining code has required that to prospect one must be licensed by the Government and must specify to the National Department of Mineral Production what metal or metals one is looking for, the exact limits of the area to be

(*Continued on page* 105)

## Deep Mining for Gold at St. John D'el Rey

**MINES—Morro Velho: reserves, 5,000,000 tons; output, 18,500 tons per month. Espirito Santo: reserves, 4,000,000 tons; output, 8,000 tons per month. Faria and Bicalho mines: reserves, 250,000 tons. Grade runs about 9 to 14 grams gold per ton.**

**MORRO VELHO MINE—Worked by rill stoping (cut and fill) to depth of 8,050 ft. (See article by John Huttl, April 1942, p. 47.) Lowest workings reached by five vertical shafts, two inclines, and one winze. Broken ore, hand-loaded into ½-ton cars, hauled out to mill in same cars, which are then used to return surface rock for backfilling.**

**DRILLING—Stoper drills use ⅞-in. hexagonal solid steel; rounds are 3 to 4 ft. Drift rounds are 5-ft., drilled with 1⅛-in. hollow steel. Drilling is dry. No detachable bits used. Management reports high rock temperatures heat bits red hot, make it impossible to remove detachable bits.**

**MILLING—Ore crushed, sorted, ground to 30 mesh in stamps, reground as required in ball and tube mills, classified, tabled to make gold concentrate, tailings cyanided. High-arsenic portion of cyanide tailing is floated to recover sulphides, which are roasted, then re-cyanided. Gold is sold by Banco de Brasil in ½ to 2-kg. bars for an average price of 25.20 cruzeiros ($1.39) per gram.**

# A Survey of Mining Progress

## Part II

**A. H. HUBBELL,** Managing Editor

As is true of rock drilling, discussed in the February issue along with underground blasting and mucking, underground haulage and transport practice appears to be entering upon important changes. Some of these are already to be seen in places. Diesel locomotives, rubber-tired shuttle cars, and conveyors present interesting possibilities for economy where conditions permit their adoption. Hoisting and hoisting safety are also considered.

*Haulage and transport are discussed here together, for obvious reasons. Diesel locomotives, hitherto regarded as suitable for work on the surface only, are included in our survey, and with good reason. Scraping, which combines the loading, hauling and transportation functions, has already been considered in connection with mucking, in the February issue.*

### Diesels Finding Place in Underground Haulage

**The Diesel Locomotive.** Bureau of Mines officials, once strongly opposed to employing internal-combustion engines in underground workings, have reversed their opinion as to diesel locomotives, after long study of the reportedly successful, extensive use of them in underground mines in Europe. Given adequate ventilation, this locomotive, they now hold, when suitably built and carefully maintained, is efficient and entirely safe. Already some of the metal-mine operators, putting aside long-standing prejudice, are investigating the possibilities it offers of cutting haulage costs.

The Bureau, according to D. Harrington, having issued a schedule for testing diesel locomotives for gassy and dusty coal mines, is now preparing a similar schedule for testing them for use in non-coal mines. The provisions of the second schedule will naturally be less drastic.

The schedule for coal mines recommends that use of diesel locomotives underground be restricted to haulageways where positive ventilation is maintained mechanically. Enough ventilating air must be supplied to dilute all toxic or objectionable constituents of the engine exhaust so that the air of the haulageway and adjacent workings will meet recognized hygienic standards. The discharged mixture must not contain more than 100 parts per million, by volume, of carbon monoxide; 25 parts of oxides of nitrogen; or 10 parts of aldehydes, under any conditions of operation. The controlling noxious gases are nitrogen oxides, which under accepted limits are 10 times more deadly than carbon monoxide.

Use of diesel locomotives in tunneling operations is attended with greater risk, according to the Bureau. Recent observations indicate that it is dangerous to operate even the best available diesel locomotives in tunnels lacking adequate ventilation. They cannot be used indiscriminately.

Word from abroad via a returned Bureau official has it that more than 1,300 diesels are being used in European mines, mostly in the coal industry. Twenty-five diesel locomotives are said to be in use in British gassy coal mines, moreover, and applications have been granted for 50 more. To this may be added a report from Australia of a colliery that is planning to install 25-ton diesel locomotives; also of a 10-ton unit at another mine, which is giving no trouble from fumes. Likewise, according to a Johannesburg correspondent, in South Africa 3-ton diesel locomotives, of 12 to 20 hp., are being used more extensively in place of battery units, the advantages claimed being: lower first cost, no need of a charging station, and freedom to move from one part of the mine to another.

Speakers at the Denver meeting of the American Mining Congress last September expressed the opinion that many mines in the United States at present lack the ample ventilation that is necessary if diesel engines are to be used underground, even though provided with an exhaust-gas conditioner.

### Domestic Installations

For main-line haulage, the Idarado company, in driving its Treasury tunnel, at Ouray, Colo., now in more than 13,000 ft. and at 10,600 ft. elevation, uses a 6-ton diesel locomotive, rated at 65 hp., which is able to handle 120 cars, each holding 3 net tons of ore, the grade in places being nearly 2 percent. The locomotive is equipped with an exhaust-gas conditioner, and noxious gases are said to have given little trouble. A Bureau test showed no carbon monoxide and only 13 and 17 parts of nitrogen oxides per million.

Introduction of diesel-driven trucks for underground haulage by Eagle-Picher in the Tri-State district in January 1946 is reported to be highly successful. This innovation is discussed in detail in an article elsewhere in this issue. The hazard of carbon monoxide is said to have been reduced to a permissible low by a new treatment for the gases that involves oxidizing CO to $CO_2$. Acquisition of four more trucks is

planned. Oklahoma and Kansas are reported to have amended their mining law banning diesel locomotives underground.

The Bureau of Mines plans to do experimental work with diesel locomotives in an oil-shale mine at Rifle, Colo.; also in the Tri-State district with cooperation of the companies and in underground limestone mines in Missouri.

Gasoline engines are also being used underground in two properties. In one case, two haulage motors powered by V-8 engines are in service on a long tunnel haul. Another company is using a gasoline-driven speedster for inspection and supervision. Ventilation is excellent at both places.

## The Outlook

In general, it would seem that if diesel haulage can be used in gassy coal mines, any mining company, irrespective of the mineral mined, should be able to use it with safety, if only to test for itself the advantages ascribed to it, provided the ventilation be adequate. Tests made at frequent intervals on men exposed to diesel fumes after these have been purified, are reported to have shown no ill effects. Inasmuch as the value of good ventilation underground is generally recognized today in the metal-mining industry, and the number of companies which endeavor to provide it is steadily increasing, it will not be surprising if diesel haulage makes considerable headway in the not-so-distant future. The locomotive alone has to be changed. The trackage remains the same, and bonding of rails becomes unnecessary. As shown, there are only a few installations in this country.

## Electric Haulage Remains the Standard Practice

**Trolley vs. Battery Locomotives.** Whatever the possibilities that the diesel locomotive may offer for the future, electric haulage continues to dominate the mining picture. The relative position of the trolley and battery types is much the same as it has been for years. Both have their proper fields, the trolley locomotive having been considered best where hauls are long and large capacity is wanted. The battery locomotive is very flexible up to the limit of its ampere-hour capacity. It also makes the overhead wire unnecessary.

One builder makes the trolley type in 4-, 6-, and 8-ton sizes for gathering and in 10-, 15-, and 20-ton units for hauling. The same company's line of battery locomotives embraces a range of chassis weights from 2,000 to 30,000 lbs.

Typical use of battery locomotives is exhibited by a large Canadian company which employs this kind for gathering on main haulage and for hauling on those levels where size of operation and length of haul do not warrant trolley service.

## For Full-Shift Operation

Higher battery capacities are available today. During the year a 36-cell C6 battery, with a capacity of 14.58 kw.-hr., has been commonly furnished with small trammer locomotives instead of the 40-cell A5 battery, formerly supplied, which has a capacity of 9 kw.-hr. As one battery manufacturer explains, this is due to a desire to have ample capacity to operate full shift under varied conditions as to duty cycle. The new development is in line with the substantial increase in battery capacities that has been applied to industrial trucks in recent years.

Use of an electric eye on the main haulageway at one mine to sound a horn in the auxiliary haulageway, thereby announcing the approach of a train from either side of the intersection, is reported from a Colorado mine.

The electric eye is also used at Climax to open and close ventilation doors in the haulageway.

At another Colorado mine a small tugger hoist is used to spot cars for loading, thus releasing the haulage locomotive for other purposes.

To prevent the operator from moving small locomotives accidently by turning the controller when walking alongside, the Atlas Car & Mfg. Co. developed a safety interlock which makes it impossible to move the motor save when the man is in his seat with his foot on the safety switch.

**The Shuttle Car.** Where distances are fairly short and mine openings are of large cross-section, rubber-tired shuttle cars and trucks of equivalent character find their natural field. Installations of the former have increased but slowly in number in the last few years and are to be found at somewhat more than a dozen mines, all of them non-metallic. The number is expected to increase. Of the trucks only one installation occurs to mind—that of the Eagle-Picher company in the Tri-State zinc and lead district, already mentioned in connection with diesel-powered transport.

Two experimental installations of the Joy shuttle car are planned for metal mines in the Southeast. One of them, comprising one car which is to be loaded by a loader of the same manufacturer, should shortly be at work in a section of a Birmingham iron mine. The other, ordered for a non-ferrous mine, is to be loaded by a scraper at the outset.

Shuttle cars in service include two types: the four-wheel self-contained unit with conveyor for loading and unloading, and the tractor and bottom-drop trailer. Power is supplied (1) by cable carried on a self-winding reel; (2) by double trolley for long hauls; (3) by storage battery; and (4) combination battery and trolley. Though the present shuttle cars are well designed and built, a greater ruggedness would seem to be desirable to permit them to penetrate far into the field of iron ore and some other metallic minerals.

Shuttle cars thus far used in *E.&M.J.'s* field are to be considered in connection with caterpillar-mounted loading machines. Such use has been widely applied in mining gypsum, as E. R. Cushing stated in *Rock Products* last August. The loaders load 2 to 8 tons per minute, and shuttle car capacities range from 4 to 10 tons. The cars operate at 3½ to 4 mph. loaded, and at 4 to 5 mph. empty, and unload in less than a minute.

## Loader and Car Make Flexible Combination

The combination of loader and car, according to Mr. Cushing, offers as advantages: maximum flexibility of operation; elimination of track work and track haulage in the working place; reduction of main-line track work and haulage to a minimum by allowing long room lengths; the holding of loader-time losses to a minimum by spotting the car hopper directly under the loader discharge boom; the ability to load waste rock in the shuttle car for removal; and maintenance costs of only 3 to 5¢ per ton.

Mine cars used underground in metal mining still exhibit their customary variety of type and capacity. No one "best" design has

evolved or at least been adopted. The end-dump type predominates among cars of 1-ton size, and the Granby and rigid-body rotary-dumping types are most common among the large cars, with the gable- or V-bottom, rocker-dump and bottom-dump in between. Capacities range from 1 to 10 tons, rarely larger. Plain bearings have largely passed out, in favor of anti-friction bearings, save for the smallest cars.

For main haulage a Colorado mine is using a spring-mounted car of 105-cu. ft. capacity. The fact has already been noted that a certain company seeks to design a car better adapted for use behind a mechanical shovel.

## Underground Conveying Gets More Attention

**Belts and Shakers.** Underground transport on belt and shaker conveyors is slowly finding application. Mines in *E.&M.J.'s* field exhibiting installations of either are still rather limited in number. Such slowness seems to be not unusual. Witness the slow adoption of the mucking machine throughout the twenties and well into the thirties in contrast to the subsequent much accelerated pace.

Belt conveyors, having demonstrated their usefulness and economy in open-pit work, not only in the bottom but where long centers and high lifts are involved in transporting material up and out of the pit, offer interesting possibilities for the longer distances underground where a drift can be readily maintained and the ore or rock delivered without damaging the belt. Wear is greatest at point of delivery and the transfer points. Recent improvement in belt construction now permits much longer uninterrupted distances between pulley centers, with a corresponding decrease in the number of transfer points and motor drives required.

Outstanding underground installations of belt conveyors include that in the Sullivan mine, in British Columbia, where the length and the vertical distance are respectively 2,496 ft. and 680 ft.; also the combination of belts and shaker conveyors, with belts for main haulage and shakers as feeders, that is being installed in a Lake Superior iron mine.

**Shaker Conveyors.** These are suitable for handling coarse or fine and preferably dry materials over intermediate distances. In the Iron Country today five installations, existing and projected, are known, as compared with two a year ago, so it would seem that their possibilities are making some impression on the operator's mind. For other installations one may look to Arizona, where two copper companies, Kennecott and Miami, have used them for six years in connection with block caving, each shaker discharging directly into a raise.

Cost of operation and maintenance of the shaker conveyors at Kennecott's Ray mines over a three-year period was 7.5¢ per ton, according to R. W. Thomas, general manager, at the Mining Congress' September meeting. Items composing it were: Pans and liners, 0.75¢; installation and operation, 2.18¢; maintenance, 4.27¢; and power, 0.30¢. The future cost is expected not to exceed 6.5¢ per ton. The company hopes to mine thicker orebodies than now possible, as well as some thinner ones, by discharging each shaker on to a cross belt conveyor instead of into a raise. It feels that shakers have a definite place in metal mining.

At Miami, sixteen 2-shaker units are in continuous use, having handled more than 4,000,000 tons of ore since they were installed, the present rate being 750,000 tons per year. In competition with scrapers (handling 1,125,000 tons), the shakers (handling 2,250,000 tons) showed costs and tons-per-man-shift to be slightly in their favor. Here the weight of ground was the deciding factor. With shakers, 80% of minor repairs on caps and back lagging could be made without shutting down, whereas scraping had to stop to permit such work. Moreover, the shakers loaded faster —at the rate of 1.25 tons per minute, against 0.60 ton with a 42-in. scraper. They also made less dust.

## Shakers in Mexico

To speed filling and the mining cycle in general and to cut the cost of distributing fill in cut-and-fill stoping in a large silver-lead-zinc mine in Mexico, a single shaker conveyor was tested and found satisfactory, delivering 75 metric tons per hour up to 220 ft., with an operating saving of 4¢ per ton of waste. On being enlarged, the installation gave satisfaction up to 400 ft. A cost comparison for a 328-ft. haul follows.

With shaker conveyor, the operation cost per ton (U. S. Cy.) was $0.035, including $0.013 for labor, $0.002 for power, and $0.020 for maintenance and replacement.

With battery locomotive and 40-cu. yd. side-dump cars, the corresponding cost per ton was $0.067, including $0.045 for labor; $0.001 for power, and $0.021 for maintenance and replacement.

Beyond the distance given, the saving drops off rapidly and locomotive haulage soon shows its superiority.

## Novel Ore Transport

Before leaving the subject of transport, one may well recall the novel method of transporting ore in pipe lines while suspended in a heavy medium, proposed not so long ago by C. Erb Wuensch; likewise his proposal to crush ore underground, separate the coarse waste by a sink-and-float procedure, stow the reject as backfill, and pump the sink product to surface in suspension.

## Hoisting Economy, Safety, Smooth Running Sought

**Innovation in Hoist Design.** The rather infrequent new developments in hoist design include that of a double-drum unit built (by Nordberg and Allis-Chalmers independently upon specifications supplied by the Soviet Government) without a bearing between drums, this requiring a heavy drum shaft 30 in. in diameter. The drums, one keyed and one clutch-driven, are each 12 ft. in diameter with a 7-ft. winding face, which takes two layers of 1¼-in. rope. An additional feature is that all operating levers, gages, and instruments are mounted on a steel desk-type console. The hoist is powered with two motors. Each builder named supplied a large number of these hoists for the post-war rehabilitation of the Donets coal mines.

**Up-to-Date Hoist Control.** The improved systems that have been introduced for controlling the hoisting operation are finding wider application. That developed by General Electric involving the use of the small amplidyne generator in conjunction with the Ward Leonard system, permits control of the hoist with a field current of less than 1 amp., whereas previously such control apparatus had to be large enough to handle 100 amp. Rapid, smooth, precise operation results, reducing maintenance of the Ward Leonard set.

(*Continued on page* 82)

# Improved Cage Safety Catch Developed at Canadian Mine

**R. K. KILBORN,** Mechanical Superintendent, McIntyre Porcupine Mines, Ltd., Schumacher, Ont.

THE SUBJECT OF SAFETY CATCHES became one of immediate interest to Ontario mine operators following the disaster at the Paymaster mine, in February 1945, which killed 16 men. The accident was investigated by a Royal Commission *(E.&M.J.*, Nov. 1946, page 76), which stimulated to a still greater degree the general interest in equipping mine cages with effective safety devices. A dependable safety catch for mine cages, possessing all the necessary attributes, has never been built. It was nevertheless believed that thorough investigation, starting with the basic principles and requirements, could bring about great improvement over the safety dogs commonly in use on mine cages in Canada. Various reports published on this subject include the findings of Royal Commissions in Great Britain dating back to the last century, a German investigation printed in 1902, and a report by the Transvaal Rope and Safety Catch Commission published in 1907. After a thorough study of these reports work was started in an attempt to meet ideal specifications as closely as possible.

The first question to be decided was whether the braking mechanism should be of the friction or the toothed dog type. A friction brake, it was felt, would lack dependability because of unknowns such as variable coefficients of friction between the brake shoes and the wooden guides, caused by changing moisture conditions at various depths; and guide wear, making it almost impossible to design a brake shoe that would at all times make proper contact with the braking surface of the guides. A toothed dog was therefore decided upon as the logical type of safety catch.

Instantaneous action of safety dogs upon release of rope tension is a standard feature of the usual devices. Non-reversible action was not difficult to design, utilizing the usual flat leaf type of spring. Prevention of the dogs from coming into action when not required, due to pulsation of the hoisting rope, was effected by using a weight and spring to counterbalance the dogs when in the off position.

To meet the requirements in item (5) of the ideal attributes listed elsewhere it was necessary to find the resisting force of B.C. fir to an embedded metal tooth drawn through the wood in a direction parallel to the grain. This was ac-

## Essential Attributes of Safety Catches

**1. Instantaneous action upon release of hoisting-rope tension.**

**2. Non-reversible action, such that, once the dogs have contacted the guides, they cannot be released without actually raising the cage.**

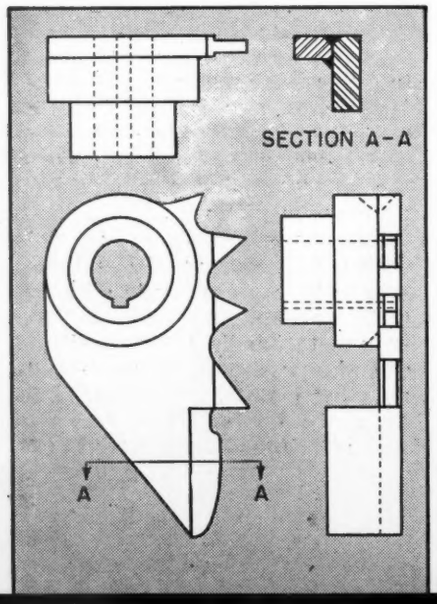
**3. Prevention of the dogs from coming into action, when not required, because of pulsations of the hoisting rope.**

**4. The entire mechanism must be light but of ample strength.**

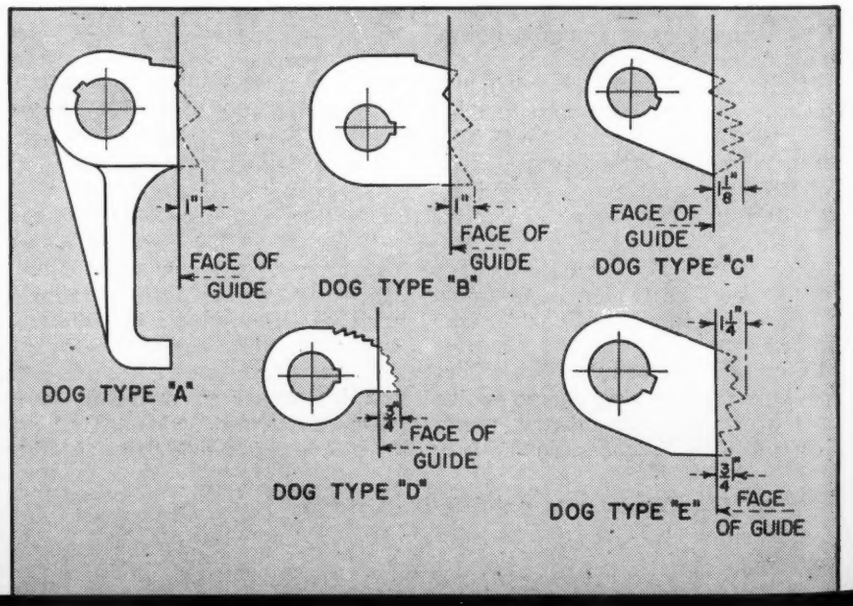
**5. The resisting force of the dogs must be adequate to bring the cage to rest without undue shock to the occupants. Velocity of retardation must be kept as low as possible. (Probably not more than 2 *g*).**

**6. The dogs should be designed to compensate automatically for guide wear. The depth of tooth penetration should be constant.**

**THE KILBORN SAFETY DOG (patented in U. S. and Canada), showing tail piece**




**FIVE TYPES of safety dogs were tested in a special jig to determine the final design of tooth section (See Table 1)**



complished by building a jig, on which were installed, in turn, the safety dogs, A, B, C, D and E shown in the accompanying figure. Short lengths of B.C. fir guides were forced through the jig between the dogs by means of a hydraulic press. The resisting force in pounds produced by the dogs was read on a pressure gage mounted on the press. Table 1 summarizes these tests.

The results of the tests showed that, as a rule, the largest guide section gave the highest resisting force. The average resisting force of the tooth surface embedded in the guide, 7,734 lb. per sq. in., was taken as the factor required in the design of a tooth section that would bring a falling cage to rest at a predetermined speed of deceleration.

Assume the weight of a cage and man load to be 5,000 lb. and the rate of deceleration to be 2 gravities. Required, the area of dog teeth to be embedded in the guide, at a resisting force of 7,000 lb. per sq. in.
R = resisting force = Wt. of cage × (1 + desired rate of deceleration) = 5,000 × (1 + 2) = 15,000 lb. Therefore, required tooth area = 15,000/7,000 = 2.14 sq. in.

It is found that a set of four dogs having a tooth width of $\frac{5}{8}$ in. and a tooth length of $\frac{7}{8}$ in. will give the desired section and a deceleration rate of 2 gravities. In actual practice I believe that a calculated deceleration rate of 1½ gravities will provide an ample factor of safety, as in many instances the resisting force is over 7,000 lb. per sq. in. In all the tests made there was never found a resisting force so low as to allow failure when the dogs were calculated to decelerate at 1½ *g*.

**Table 1. Tests of Safety Dogs**

| Test No. | Dog Type | Width of Dog, in. | Dimensions of Guide, in. | Depth of Tooth Penetration in. | Length of Cut on Guide, in. | Maximum Load on Dog at Failure of Guide, Lb. | Load, Psi. | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | A | 2⅞ | 4½x3⅝ | 1 | 8¼ | 46,200 | 8,035 | Cast-steel dogs, very dull teeth |
| 2 | A | 2⅞ | 5½x3¾ | 1 | 9 | 54,000 | 9,400 | Cast-steel dogs, very dull teeth |
| 3 | A | 2⅞ | 7½x5¼ | 1 | 8¼ | 54,000 | 9,400 | Cast-steel dogs, very dull teeth |
| 4 | B | 2¼ | 4½x3⅝ | 1 | 9 | 33,000 | 7,330 | Steel dogs with machined teeth, sharp |
| 5 | B | 2¼ | 5½x3¾ | 1 | 8¼ | 31,800 | 7,070 | Steel dogs with machined teeth, sharp |
| 6 | B | 2¼ | 7½x5¼ | 1 | 8¼ | 54,000 | 12,000 | Steel dogs with machined teeth, sharp |
| 12 | C | 2¼ | 4½x3⅝ | 1⅛ | 6 | 25,400 | 5,310 | Machined dogs with sharp teeth |
| 13 | C | 2¼ | 7½x5¼ | 1 | 5½ | 40,000 | 8,880 | Center teeth project beyond bottom tooth |
| 7 | D | 2½ | 4½x3⅝ | ¾ | 6½ | 26,000 | 6,900 | Cast-iron with small dull teeth |
| 8 | D | 2½ | 5½x3¾ | ¾ | 6 | 27,300 | 7,280 | Cast-iron with small dull teeth |
| 9 | E | 2½ | 7½x5¼ | 1¼ | 6 | 54,000 | 8,640 | Cast-steel center teeth project ¼ in. beyond bottom tooth when fully engaged |
| 10 | E | 2½ | 5½x3¾ | 1¼ | 6½ | 32,000 | 5,120 | |
| 11 | E | 2½ | 4½x3⅝ | 1¼ | 6 | 32,300 | 5,180 | |

Average—7,734 lb. per sq. inch of tooth surface embedded in guide (bottom tooth area only considered).
Note: All guides used in the tests were B. C. fir.
Dogs A, B, C, D, and E are shown in the accompanying sketch.

**Table 2. Tests of Safety Dogs**

| Test No. | Weight of Cage & Load Lb. | Length of Free Drop | Deceleration Distance | Total Length of Fall | Velocity of Cage When Dogs Set f.p.m. | Rate of Deceleration Ft./sec./sec | Resisting Force, Psi. | Size of Teeth, in. | Area of Teeth on 4 Dogs Sq. in. | Size of Guides, in. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 5,000 | 7′–6″ | 4′–2″ | 11′–8″ | 1,314 | 57.4 | 3,720 | 1¼x¾ | 3.75 | 5½x7½ |
| 2 | 9,000 | 7′–6″ | 6′–8″ | 14′–2″ | 1,314 | 35.9 | 5,090 | 1¼x¾ | 3.75 | 5½x7½ |
| 3 | 9,000 | 7′–6″ | 8′–9½″ | 16′–3½″ | 1,314 | 28.3 | 6,475 | ¾x¾ | 2.62 | 5½x7½ |
| 4 | 9,000 | 7′–6″ | 15′–7″ | 23′–1″ | 1,314 | 15.1 | 7,575 | ¾x½ | 1.75 | 5½x7½ |
| 5 | 5,000 | 8′–3″ | 27′–3½″ | 35′–6½″ | 1,380 | 9 7 | 6,520 | ½x½ | 1.00 | 5½x7½ |
| 6 | 9,000 | 7′–9″ | 11′–7″ | 19′–4″ | 1,336 | 21.2 | 8,530 | ¾x½ | 1.75 | 5½x7½ |
| (a) 7 | 9,000 | 7′–9″ | 21′–3″ | 29′–0″ | 1,336 | 11.7 | 7,000 | ¾x½ | 1.75 | 5½x7½ |
| (b) 8 | 3,325 | 7′–9″ | 4′–4″ | 12′–2″ | 1,336 | 57 3 | 9,275 | ½x½ | 1.00 | 5½x7½ |

All guides used in these tests were old and worn B. C. fir, and had been discarded from the McIntyre No. 11 shaft.

(a) To duplicate conditions in a very wet shaft the guides were immersed in water for two weeks prior to test, and water sprays were placed at the top of the test tower discharging a heavy stream of water down each guide.

(b) For this test the hoist rope was attached by means of a light wire to the hoist. The cage was released with the ¾-in. rope attached. The wire broke and the ¾-in. rope was jerked violently ahead. The dogs engaged the guides as readily as in the previous tests without the trailing rope. It should be noted that the deceleration rate in this test appears to be high. Very probably the trailing rope retarded considerably the acceleration rate so that the cage did not attain a speed of 1,336 ft. per min.

## Drop Tests Conducted

The next step was to conduct actual drop tests with a loaded cage. A 54-ft. tower was erected to accommodate an average size mine cage. Table No. 2 records the results of eight of these tests. Deceleration rates of from ⅓ to 1.8 gravities were recorded. The average resisting force on the dogs was 6,773 lb. per sq. in. Should safety dogs calculated to stop a falling cage at 1½ gravities with a resisting force of 7,000 lb. per sq. in. encounter guides that gave only a resistance of 3,720 lb. per sq. in., the cage would decelerate at a rate of 0.797 gravities and come to a stop.

Automatic compensation for guide wear was accomplished by placing a tail on the safety dogs, and providing the tail with a pad that contacts the worn portion of the guide. The tail prevents the dog from rotating past its most effective position, and as the pad follows the contour of the worn guide it automatically compensates for guide wear. The dog shown in the accompanying sketch, which incorporates these features, is designed to have a tooth penetration into the guides of $\frac{7}{8}$ in. This compensating arrangement for guide wear is most important. Dogs equipped with fixed stops are generally set to allow from ¾ to 1¼ in. of penetration into guides of full section. Obviously, if ½ in. or ¾ in. is worn off each side of a guide the tooth penetration is proportionately reduced, possibly to an extent that would cause failure in an emergency.

In designing the teeth of the dogs a great deal of time and care was exercised, using pasteboard models, to ensure that the three top teeth would roll into the guide in such a manner that the wood between the teeth would not be crushed and the bottom or bearing tooth would be positively drawn into the wood. The

Action is similar to a pinion of large diameter rolling on a rack.

A satisfactory design of the actuating mechanism for safety dogs must possess both adequate strength and lightness. To analyze the stresses developed when safety dogs grip the guides it is necessary to know the resisting force reated by the guides against the dogs. This force is transmitted by the dogs to the dog shaft. Many arrangements of safety dogs are provided with a stop that engages the actuating mechanism. In these cases the dog shafts have to withstand shear, torque and bending. In some recent tests made at mines in Ontario for the Department of Mines, the dog shafts have failed in both bending and torque.

A dog equipped with an integral stop contacting the guide, such as illustrated, eliminates any stresses due to torque. By equipping the dog with an integral hub of sufficient size to take all the shear, and by making the hub of generous length, the dog shaft is relieved of both shear and bending. This allows the use of a light shaft which materially reduces the weight of the whole mechanism. The actuating mechanism was designed in this manner, using a resisting force of 7,000 lb. per sq. in. of tooth surface.

To ensure trouble-free operation every moving joint is placed in a bronze bushing provided with alemite fittings which can be greased at cage inspections.

The use of a flat leaf spring offers a simple arrangement, open at all times for examination. A maximum allowable spring tension should always be used. On deep shafts and at high speeds, where the cage is subject to considerable bouncing due to rope stretch, the spring tension should not be more than 50% of the weight of the empty cage. On shallower shafts, of 1,000 or 1,200 ft., and at slow speeds a spring tension equal to two-thirds of the weight of the empty cage may safely be used.

The question has often been raised as to whether dogs suddenly coming into action at high speeds would throw such a strain on the guides or dogs as to cause a wreck. The answer is definitely in the negative. Irrespective of the type of dog used, it can create only a constant resisting force whether the cage is traveling at 500 or 5,000 ft. per min. The velocity of deceleration will be the same. The only variable is the distance required to bring the cage to rest.

The Ontario Department of Mines has placed its approval on this safety device, and it is now in use or being installed at several mines in the province.

# Making Tin Flotation Work—No. 4, San Jose Ore

**A. M. GAUDIN and R. T. HUKKI,*** Richards Ore Dressing Laboratory, Massachusetts Institute of Technology, Cambridge, Mass.

THE SAN JOSE MINE, Oruro, Bolivia, has long produced silver and tin, but in recent years grade of ore has been low and treatment complex. In 1942, ore was hand-sorted and jigged at the mine, then transported 20 miles to the Machacamarca mill and smelter. Here this preconcentrate was chloride-roasted, leached with hypo to recover silver, then ground and gravity-concentrated for tin. Over-all tin recovery was estimated at 25 to 30%; operating cost was high.

Laboratory tests were conducted from June 1943 to December 1944 under cooperative arrangements involving Dr. Mauricio Hochschild, S.A.M.I., the senior author, and the Division of Industrial Cooperation of M.I.T.

Sampling of one ton of San Jose ore, received June 10, 1943, gave the following results: tin, 1.39%; silver, 6.1 oz.; iron, 23.6%; silica, 31.5%. Sulphides and non-sulphides occur in about equal amount. Pyrite is the most abundant sulphide (90 to 92%); marmatite and stannite (account for about 7 percent of the tin) are the commonest remaining sulphides, but stibnite, molybdenite, and sulpho-salts of silver, lead, and copper are also present in finely-divided association. Several of these gray sulphides are the silver carriers.

Among non-sulphides, there occur cassiterite, quartz, and several finely-intergrown silicate minerals. Quartz is most abundant.

Although cassiterite occurs in particles as large as 200 microns, much of it is fine and occluded within pyrite, or intergrown with other sulphides. Later in our work, however, certain difficulties were traced to cassiterite-non-sulphide locked particles.

Our proposals for San Jose ore include the following major steps:

1. Grinding.
2. Collective flotation of sulphides.
3. Selective flotation of silver and sulphide-tin minerals from pyrite.
4. Selective flotation of cassiterite from non-sulphide gangue.

**The Grind.** Intimate intergrowth of cassiterite makes it impractical to grind all the ore to liberate all the tin. Instead our plan aims at grinding extra fine only those portions of the ore that need it. In much of our work, the primary grind was to minus 150 mesh. After secondary grinding, the sulphides were substantially minus 325 mesh. Table I shows how tenaciously the cassiterite is retained in the pyrite and how successive grinds and refloats increase grade of non-sulphide rejects.

Although steel mill grinding at first prevented good flotation, even

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This is the last of a series of four articles on flotation of various Bolivian tin ores. The series began in E.&M.J. for October, 1946.

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with xanthates, later tests with steel mill grinds were successful using fatty-acid collectors in acid circuit to remove sulphides. This pulp water was decanted and fresh water used before subsequent non-sulphide flotation.

**Bulk Sulphide Float.** Collective sulphide flotation has been accomplished on pebble-mill grinds with xanthates at natural pulp pH (near 4), on pebble-mill grinds with xanthates in pulps made neutral or slightly alkaline with soda ash or lye; and on steel-mill or pebble-mill grinds with oleic acid at pH 2 to 3. Typical data for various procedures appear in Table II.

**Stannite-Silver Float.** In order to recover primarily the sulphide silver minerals, and secondarily minerals of copper, lead, and tin (as stannite-locked cassiterite), a stannite-silver float follows the bulk sulphide float in highly alkaline circuit. Typical results are shown in Table III. The float will work with lime as the only alkalizing agent, but it is cleaner and more easily controlled when lime and lye are used. Perhaps calcium sulphate concentration is more favorable when using the two alkalies.

**Cassiterite Float.** The combined non-floats from the bulk sulphide floats consist principally of quartz, foliated silicates, and cassiterite. Also present are minor quantities of tourmaline, topaz, and fluorite, and minor but significant amounts of locked sulphides. In the non-float liquor are dissolved salts of ferrous iron, calcium, aluminum, and magnesium. By sulphide flotation standards these amounts (Table IV) are insignificant, yet they become important in cassiterite flotation.

Use of fatty acids to float the cassiterite in about neutral or slightly alkaline circuit gave better results than cationic agents did. Various practices, to be described, were also required to enhance selection of cassiterite from gangue. The pulps, as a whole, had to be dispersed, although the cassiterite always looked clotted or flocculated when separation was best.

The following modifying practices and agents were used:

1. Sulphide non-float leached with sulphuric acid, leach liquor then washed out.
2. Sulphide non-float aerated at pH 7 to 10.
3. Cation-complexing agents and other modifiers added to pulp brought up to pH 7 to 8.5.

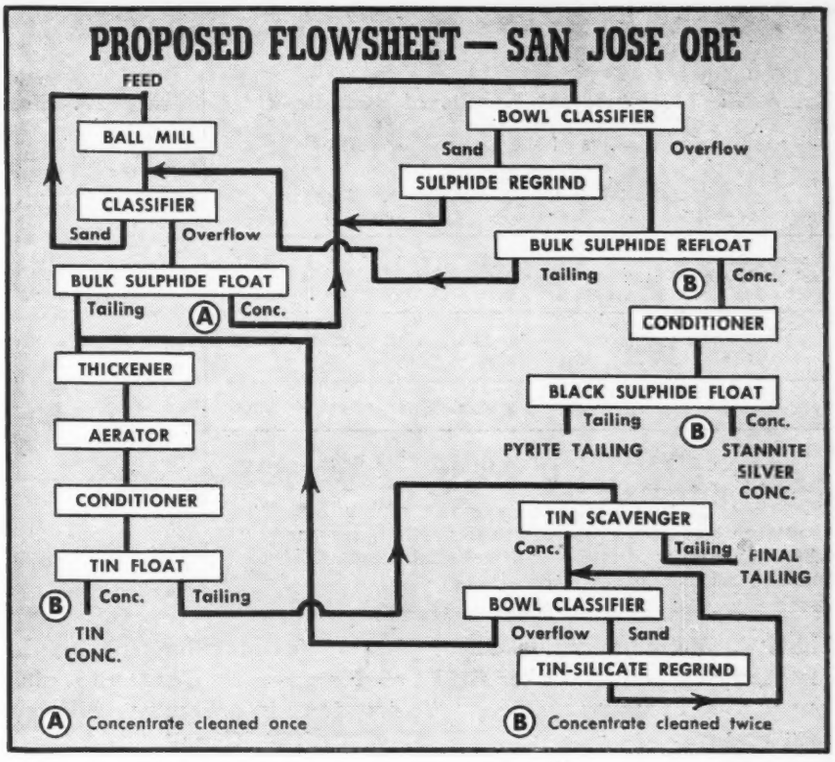



**Table I. Metallurgical Results Showing Locking of Cassiterite with Sulphides, San Jose Ore**

| | Weight % | Tin Assay % | Tin Distribution % |
|---|---|---|---|
| Final sulphide float.. | 49.6 | 0.59 | 20.9 |
| Non-float from step a | 40.7 | 2.01 | 59.0 |
| Non-float from step b | 4.1 | 1.44 | 4.3 |
| Non-float from step c | 3.2 | 3.80 | 8.8 |
| Non-float from step d | 1.1 | 2.30 | 1.8 |
| Non-float from step e | 1.0 | 5.90 | 4.3 |
| Non-float from step f | 0.3 | 4.03 | 0.9 |

Two 1000-gram charges ground in pebble mill, each 30 minutes. In step "a", two charges floated separately giving finished non-float. In step, "b" combined floats from "a" refloated, giving second finished non-float. Float from "b" dewatered, ground 30 minutes, then refloated in step "c". Float from step "c" floated fourth time, "d". Float from step "d" dewatered and again ground 30 minutes, then refloated twice giving non-floats "e" and "f". Pulp throughout float was at pH about 4.0. Reagents: potassium ethyl xanthate and pine oil.

**Table II. Average Results of Sulphide Floats, San Jose Ore**

| Procedure | Weight of Sulphide Float, % | Average Tin Content of Sulphide Float, % | Percentage of All Tin in Sulphide Float |
|---|---|---|---|
| A | 53.1 | 0.44 | 16.2 |
| B | 50.8 | 0.49±.006 | 18.9 |
| C | 52.1 | 0.41±.008 | 14.9 |

Procedure A: Steel-mill grind to 90%—200 mesh, rougher float, steel-mill regrind of sulphides to 94%—325 mesh, two cleaner floats. Sulphides floated with oleic acid at pH 2.5 to 3.0 (sulphuric acid). One test included.

Procedure B: Steel-mill grind to 95%—200 mesh, rougher float and two cleanings of sulphides with oleic acid at pH 3.0 (sulphuric acid). Average results of nine tests included.

Procedure C: Pebble mill grind to 94%—200 mesh, rougher float and two cleanings of sulphide concentrate, pebble mill regrind of sulphides to 98%—325 mesh and two cleaner floats. Sulphides floated with potassium ethyl xanthate at pH 4 (natural pH). Average results of 18 tests included.

Each of these practices was effective, especially the first and the third, the latter seeming most attractive in that it does not require a separate operation. Tables V, VI, and VII, show results of first, second, and third practices respectively.

**Modifying Reagents.** To increase selectivity in the tin float, sodium hexametaphosphate (calgonite), sodium lignin sulphonate (Daxad 23), quebracho, alizarin, and morin were tested. The latter are two widely-used dyes; quebracho is a tannin and Daxad is akin to tannin. The first three reagents were suggested by parallel work on Colquiri ore. (*E.&M.J.*, Dec. 1946 and Jan. 1947). Alizarin was tested because of its ability to form lakes, that is chelate or adsorption compounds, with some metallic ions, especially aluminum, chromium, iron, tin, and lime. This reagent, whose chemistry is not yet

**Table III. Metallurgical Results of Stannite-Silver Float**

| Product | Weight, % | Assay Tin % | Assay Silver, Oz./Ton | Distribution, % Tin | Distribution, % Silver |
|---|---|---|---|---|---|
| Black sulphide float | 2.8 | 3.27 | 189.2 | 7.4 | 85.3 |
| Black sulphide middling | 2.3 | 0.45 | 13.1 | 0.8 | 4.9 |
| Pyrite reject | 42.8 | 0.22 | 1.42 | 7.5 | 9.8 |
| Bulk sulphide float | 47.9 | (0.41) | (6.21) | 15.7 | 100.0 |
| Nonsulphide non-float | 52.1 | 2.02 | tr. | 84.3 | tr. |
| Original ore | 100.0 | (1.25) | (2.97) | 100.0 | 100.0 |

Procedure: Grind and collective sulphide float substantially as procedure C, table II. Black sulphide flotation: pH 11.5 to 12.0 with sodium hydroxide and a little lime; 15-minute conditioning with cyanide; 15-minute aeration with copper salt; flotation with residual xanthate or with small added amount.

**Table IV. Removal of Dissolved Impurities Associated with San Jose Ore**

| Solution Number | Volume, Liters | Content, Grams/Liter Fe | Al | CaO | Content, Grams Fe | Al | CaO |
|---|---|---|---|---|---|---|---|
| Test A | | | | | | | |
| 1 | 8.0 | 0.12 | 0.02 | 0.06 | 0.96 | 0.16 | 0.48 |
| 2 | 10.0 | 0.05 | 0.001 | 0.01 | 0.50 | 0.01 | 0.10 |
| 3 | 9.0 | 0.04 | 0.001 | 0.007 | 0.36 | 0.01 | 0.06 |
| 4 | 10.6 | 0.03 | 0.001 | 0.008 | 0.33 | 0.01 | 0.09 |
| 5 | 3.5 | 0.002 | 0.000 | 0.003 | 0.01 | 0.00 | 0.01 |
| | | | | | 2.16 | 0.19 | 0.74 |
| Test B | | | | | | | |
| 1 | 4.1 | 0.06 | | 0.03 | 0.25 | | 0.12 |
| 2 | 11.6 | 0.06 | | 0.03 | 0.70 | | 0.35 |
| 3 | 11.8 | 0.01 | | 0.01 | 0.12 | | 0.12 |
| | | | | | 1.07 | | 0.59 |

Procedure: Test A, 3000 g.—20 mesh ore pulped with distilled water, water filtered off and ore repulped with fresh distilled water, process repeated four more times.

Test B, 4000 g. of ore was ground to 90%—200 mesh, washed three times with distilled water.

**Table V. Metallurgical Results of Flotation of Cassiterite after Acid Leaching**

| | Weight, % | Tin Content, % | Tin Distribution, % |
|---|---|---|---|
| Bulk sulphide float | 53.5 | 0.44 | 16.7 |
| Sulphide scavenger float | 2.4 | 1.54 | 2.6 |
| Tin rougher tailing | 33.4 | 0.24 | 5.7 |
| Tin cleaner tailing | 5.3 | 0.67 | 2.6 |
| Tin recleaner tailing | 1.8 | 1.12 | 1.5 |
| Tin concentrate | 3.6 | 28.0 | 70.9 |

Procedure: Bulk sulphide float: substantially as procedure C, Table II; Two hour leaching at 80 deg. C in solution of 500 cc. 12-N HCl and 100 g. NaCl and 2500 cc. water; Multiple washing until pulp solution substantially free of iron by ferrocyanide and ferricyanide tests; Scavenger float of remaining sulphides with a small amount of xanthates; Cassiterite floats at pH 6.5-6.7 with sodium metasilicate, oleic acid and pine oil.

**Table VI. Metallurgical Results of Flotation of Cassiterite after Aeration in Slightly Alkaline Circuit**

| | Weight, % | Tin Content, % | Tin Distribution, % |
|---|---|---|---|
| Bulk sulphide float | 48.8 | 0.40 | 15.0 |
| Tin rougher tailing | 33.2 | 0.28 | 7.0 |
| Tin cleaner tailing | 9.1 | 0.80 | 5.5 |
| Tin recleaner tailings | 2.4 | 0.94 | 1.7 |
| Tin 4th and 5th tailings | 2.2 | 1.98 | 3.3 |
| Tin concentrate | 4.3 | 20.8 | 67.5 |

Procedure: Bulk sulphide float: substantially as procedure C, Table II; Sulphide tailing dewatered by thickening; Aeration 30 minutes with lye and sodium metasilicate, pH at beginning of aeration 9.3, dropping to 8.2 at end; Cassiterite floated at pH 6.9 (HCl used) with oleic acid and pine oil as reagents.

**Table VII. Metallurgical Results of Flotation of Cassiterite after Aeration in Alkaline Circuit and Through Use of Alizarin**

| | Weight, % | Tin Content, % | Tin Distribution, % |
|---|---|---|---|
| Bulk sulphide float | 52.1 | 0.38 | 13.8 |
| Tin rougher tailing | 36.2 | 0.51 | 12.9 |
| Tin cleaner tailing | 7.2 | 0.82 | 4.1 |
| Tin 3rd and 4th tailings combined | 1.6 | 2.11 | 2.4 |
| Cassiterite concentrate | 2.9 | 33.20 | 66.8 |

Procedure: Bulk sulphide float: substantially as procedure C, Table II; Aeration 30 minute with soda-ash and small amount $BaCl_2$ at pH 8.5; Flotation of cassiterite with alizarin (0.27 lb. per ton total addition), oleic acid, Nujol, and pine oil at pH 7.10 to 8.5.

wholly elucidated[1], is a dihydroxyanthraquinone represented by the formula:

Dyes have been proposed as flotation agents, even for floating cassiterite[2]. However, the active ion of the dye was specified as cationic, as in methyl violet, instead of anionic as in dyes of the alizarin or morin type. Alizarin as a gangue depressant is also discussed by Gutzeit in a paper on chelate-forming compounds in *Min. Tech.*, November, 1946.

In floating cassiterite, if gangue minerals are kept properly wetted by pH control, if gangue-activating cations are complexed or are removed by leaching or washing, then quantity of collector can be reduced to sulphide flotation ranges. Thus the oleic acid used in the test shown in Table VII represents only 0.17 lb. per ton of original feed.

Mechanical froth quality is definitely improved after adding 0.25 lb. per ton of alizarin. Discrete quantities of hydrocarbon oils appeared helpful.

Microscopic examination of final cassiterite concentrates carrying 25 to 35% tin shows quartz and sulphide particles locked with cassiterite, and slimy foliated silicates, frequently locked, as the chief contaminants.

From a practical point of view the following has been established for San Jose ore.

1. For satisfactory results extremely fine grinding is required for San Jose ore.

2. Separation of cassiterite has been achieved on ore ground in steel or pebble mills.

3. Modest quantities of alizarin improved selectivity of flotation in favor of cassiterite.

We wish to express deep appreciation to Dr. Mauricio Hochschild for his unfailing interest and encouragement. Thanks are due also to Raymond R. Beard, Thomas Jackson, and the late William Val de Camp. Messrs. S. Suphi Yavasca and Frank W. Bowdish aided in certain experiments, and Donald L. Gurnsey and Julia Grandfield directed the analytical work that was required.

[1] Paul Karrer, *Organic Chemistry*, p. 547. Nordeman Publishing Co., Inc., New York. (1938).

Louis F. Fieser and Mary Fieser, *Organic Chemistry*, Chapter 34, D. C. Heath & Co., Boston (1944).

Yoe and Sarver, *Organic Analytical Reagents*, p. 132. Wiley, New York (1941).

[2] French patent No. 811, 787 to Humboldt-Deutzmotoren, A. G. (1937).

# Mining Research Evolves Clover-Leaf Burn Cut

**CLIFTON W. LIVINGSTON,** Professor of Mining, Colorado School of Mines, Golden, Colo.

EQUALLY EFFECTIVE in blasting "plastic-acting" and "brittle-acting" ground, the clover-leaf burn cut was developed through persistent study and experiment at the Kearsarge mine and later the Iroquois mine of the Calumet & Hecla Consolidated Copper Co., Calumet, Mich. Steps in the evolution of the round are presented here to acquaint the reader with the merits and defects of various rounds tried out.

The experimental work from June 1942 to April 1944 was given impetus by the urgent demand for copper, which in turn necessitated speedy development work at a time when labor was scarce. Although experiments were conducted in sinking, raising, stoping and drifting, this article is limited to a discussion of drifting experiments.

Drilling and blasting in Michigan amygdaloid copper deposits present some unusual problems because native copper occurs associated with calcite and quartz in the upper oxidized amygdaloidal zone of basaltic lava flows. Copper is erratically distributed and particles range in size from that of shot to masses weighing several hundred pounds.

Holes encountering large pieces of native copper are difficult to drill, and require rock drills with a strong rotation. Drilling speed in altered, porous, calcite-filled amygdule ground may be as high as 28 in. per minute with little loss of gage. Drilling speed in a nearby unaltered, dense trap may be 8 in. per minute, with moderate loss of gage.

## Ground Is Tricky

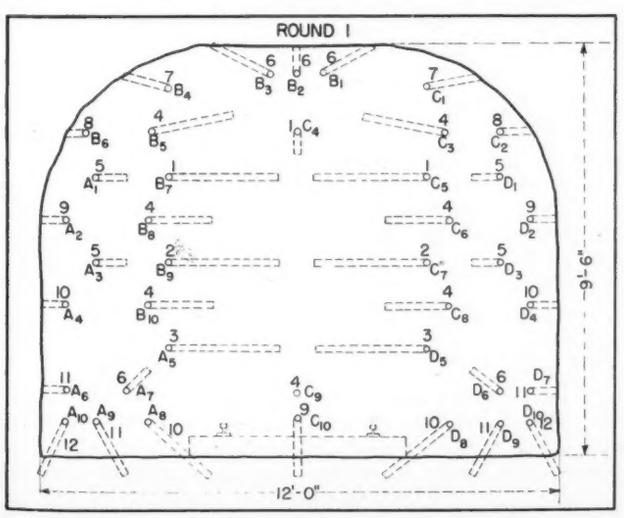
Ground is difficult to break. The larger, irregularly shaped pieces of native copper act as a reinforcement. Where calcite-filled, or partly filled amygdules are abundant the ground is "spongy." Membranes between the filled amygdaloidal cavities may collapse from the force of a blast, leaving merely an expanded drill hole. The round may break short, or overbreak, depending upon the abundance of slips and their position relative to the bottom of the drill hole.

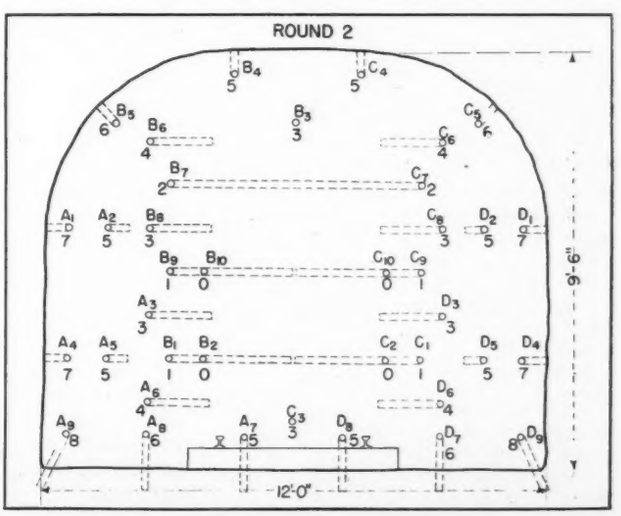
Prior to the experimental work here mentioned a "swing cut" was employed to drive the 10x12-ft. drifts. Machines were mounted on a 2-arm vertical column which was set on alternate sides of the drift for successive rounds. However, the cycle of operations and limited number of machines used in the "swing cut" were not suited to the rapid advance attained by using four-machine jumbos and mucking machines.

Drifting experiments began on the 23d level of the Kearsarge mine with the following equipment: Cleveland MDR-4 mine jumbo, Eimco Model 21 loader, 3-ton battery locomotive, and 5-ton end-dump cars. Gardner-Denver, Ingersoll-Rand, Chicago-Penumatic and Cleveland drifters were tried.

The following drawings and captions explain the successive rounds used in the drifting experiments.

**Round 1.** This is a V-cut round. Holes drilled by each machine on the jumbo are designated by a letter followed by a number which indicates the drilling order for that machine. Other numerals indicate firing order. The round provides maximum drilling room for each machine at all times. The drill pattern also eliminates unnecessary motion in spotting holes. For example, Machine A drilled holes $A_1$ and $A_{10}$. The boom is spotted in the proper lateral position at the beginning of the round and then clamped. Further motion is limited to raising or lowering the boom in a vertical plane only. Alternate raising and lowering, and clamping and unclamping of the boom are avoided. All holes are spotted using swing and dump move-



ments. Assuming normal drilling conditions, Holes $A_5$, $B_5$, $C_5$ and $D_5$ would be drilled at the same time.

**Conclusions.** 1. Average advance per round was approximately 5 ft. 2. The V-cut was not consistently broken, perhaps because too much was being pulled by the cut holes. 3. Holes $A_8$, $A_9$, and $A_{10}$ if drilled nearly parallel might be bottomed more accurately. 4. Possibly fewer holes should be used to break the side and back, and more to break the cut.

**Round 2.** Four "baby V" holes were drilled inside the 6-hole cut. Two back holes, $B_4$ and $C_4$, were used instead of three. Side holes were spaced further apart.

**Conclusions.** 1. Round 2 was better than 1 because of better hole spacing. 2. Side holes can be depended upon to shear across at least 3 ft. when bottoms are 1⅜-in. in diameter. 3. The depth of round broken did not increase, possibly because more holes were needed in the cut.

**Round 3.** A four-hole pyramid was substituted for the "baby-V" holes. Two additional holes were drilled in the V-cut, and four of the V-cut holes pulled together slightly to bottom behind the apex of the pyramid.

**Conclusions.** 1. The depth of round pulled increased from 5 to 7½ ft. and depends largely upon the type of cut used. 2. Possibly a straight pyramid cut in which great force is concentrated in the pyramid may be superior to the combination V-cut, pyramid-cut round.

**Round 4.** V-holes were eliminated. The base of the pyramid was increased to 4 ft. 6 in., and six holes were used in the pyramid instead of four. Relievers were placed as shown. Four holes were eliminated in all.

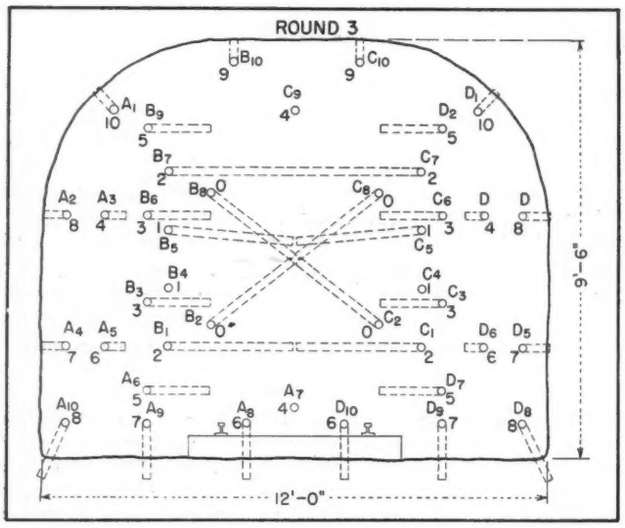
**Conclusions.** 1. The depth of round broken was as great as in Round 3. Powder consumption and drilling cost per foot were reduced. 2. The depth of round broken is directly related to the concentration of breaking force in the cut holes. However this concentration produces much fly-rock. 3. Fly-rock interfered with the operating cycle by damaging air and ventilation pipes, increasing mucking time for first few cars, and increasing time for smoke to clear out as pipes could not be kept close to face.

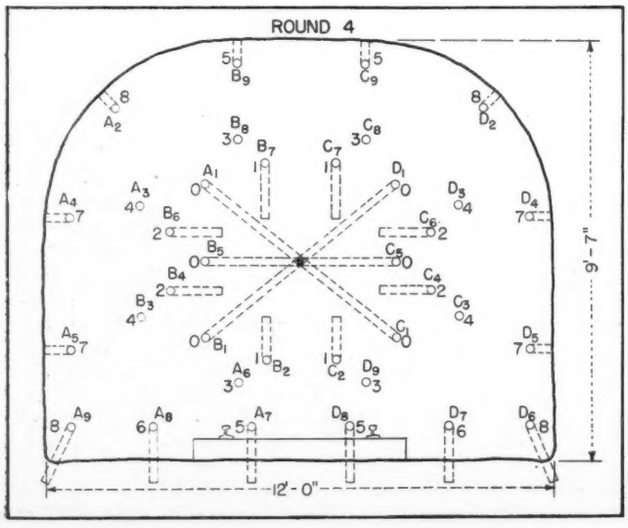
### Drifting at the Iroquois Mine

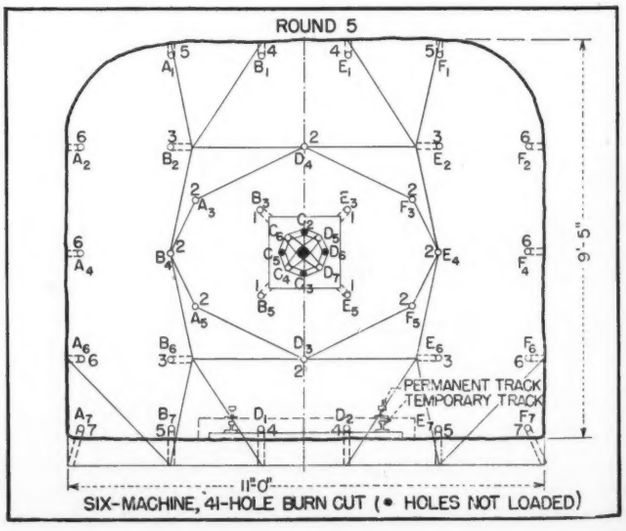
Experiments so far had been conducted at the Kearsarge mine. At this stage, roughly 800 ft. of 10x12-ft. drift had been driven. Loader and jumbo were then moved to the Iroquois mine and the experiment continued. To reduce drilling time the outside booms of the Cleveland jumbo were fitted with tee-arms, each mounting two machines. The A and B machines were mounted on the tee-arm on the outside boom used for drilling the left side of the face. The C and D machines were mounted singly on separate booms equipped with "banjo arms." The E and F machines were mounted on the tee-arm on the other outside boom. The jumbo was equipped with 3½-in. anvil-block-construction drifters for 1-in. hexagonal drill steel. A 30-in. steel change was substituted for the 24-in. change used at Kearsarge. Machines were equipped with centralizers and sliding cone shells. The jumbo car was redesigned to mount a fan and headlights, and to carry a spare machine. Additional weight to compensate for the extra machines and the tee-booms was provided by filling the rear end of the car with concrete. Power-feed machines were found superior in Kearsarge amygdaloid ground to vibration-feed machines. One-inch hexagonal steels with straight shanks were found superior to 1⅛-in. round steel with collared shanks largely because of steel breakage. The substitution of a 30-in. steel change for a 24-in. steel change eliminated one steel change in an 8½-ft. round, thereby reducing drilling time.

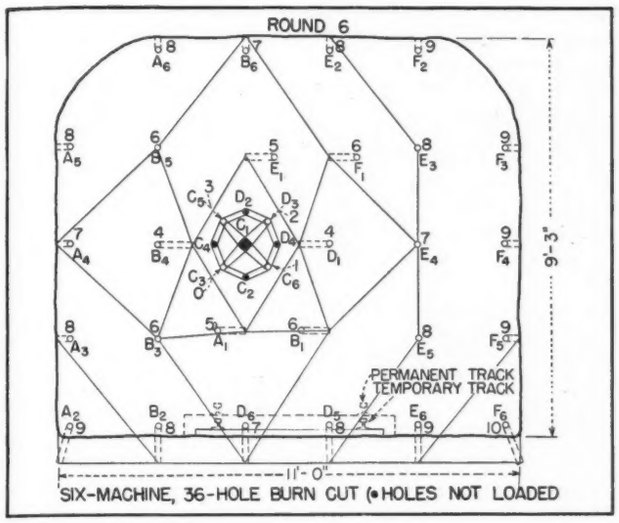
**Round 5.** This six-machine, 41-hole, burn-cut round was the first round tried at Iroquois. Nine holes were used in a 12-in. circle burn. Eight holes were drilled around the periphery of a 12-in. circle. One 2⅝-in. hole was drilled in the center. Alternate rim holes were not loaded. Four rim holes as indicated were blasted simultaneously with 0 delays.

**Conclusions.** 1. The advance per round was no greater than for rounds 1 and 2. 2. It was observed by firing the burn holes alone that the cut would not pull to bottom. The force of the blast caused the spongy, amygdaloid ground to flow and tightly re-cement in the unloaded holes. In some rounds the loaded holes merely expanded from the force of the blast. 3. The bootleg round at the bottom of the cut was badly shattered and caused difficulty in collaring holes of the succeeding round. 4. Fragmentation was good, but little fly-rock was produced.

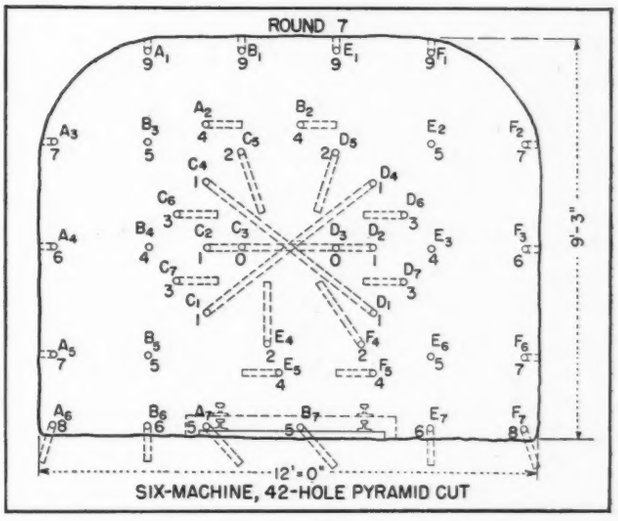




SIX-MACHINE, 36-HOLE BURN CUT (• HOLES NOT LOADED



SIX-MACHINE, 42-HOLE PYRAMID CUT

**Round 6.** This round was designed to eliminate re-cementing of bottom of the burn by rock flowage. It was assumed that too much power was concentrated in the burn circle. Therefore delayed rim-fire was substituted for simultaneous rim-fire blasting. The burn circle was enlarged to 18 in. The reliever circle was eliminated, but side holes were drilled nearer to the burn. Width of the drift was reduced from 12 to 11 ft. The number of holes was reduced to 36, and the burn-circle was placed off center. Drilling the burn on alternate sides of center eliminated the difficulty of collaring holes in bootleg ground. The blasting pattern in the "free-face" area was changed from simultaneous blasting to independent blasting.

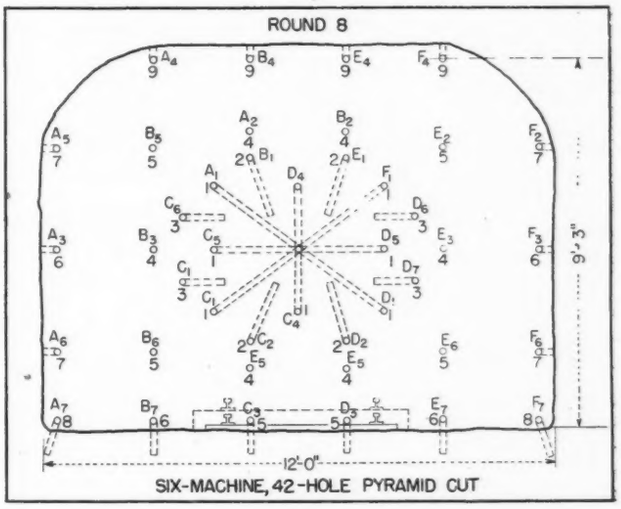
**Conclusions.** 1. The cut did not pull to bottom. Advance was poorer than with Round 5. 2. Independent blasting was not as effective in Iroquois ground as simultaneous blasting. 3. The reliever circle was probably necessary. 4. A burn cut similar to that in Round 5 was being used in shaft sinking operations in a 10 ft. x 22 ft. shaft with remarkable results. See illustration. Rounds 12 ft. deep were being consistently pulled. Why a given type of round would work well in an inclined shaft and poorly in a drift was difficult to understand. 5. The burn-cut round was abandoned temporarily.

**Round 7.** This is a "combination pyramid-cut" round, with two "baby-V-cut" holes inside a 6-hole pyramid. The round is similar to Round 4 developed at the Kearsarge mine, but designed for six machines instead of four. The two "baby-V-cut" holes were placed inside of the pyramid and the base of the pyramid was narrowed in an attempt to reduce fly-rock. The "baby-V-cut" holes were blasted with 0-delay detonators before blasting the six pyramid holes with No. 1-delay detonators. The volume of rock, comparable to that pulled by the pyramid holes of Round 4, is pulled in two parts rather than one. Fly-rock from blasting cut-holes would therefore be smaller in size and less apt to damage pipes and track.

**Conclusions.** 1. Fly-rock was reduced and mucking time decreased. 2. Instead of pulling a 7½-ft. round as expected from results at Kearsarge, the average depth of round pulled was 6 ft. 3. Six more holes had been used in the round than in Round 4 at Kearsarge. Was the reduced depth due to some unobserved physical characteristic of the rock? Or, did the action of the "baby-V buster" holes in some way interfere with the pyramid pulling to bottom?

**Round 8.** This is a straight pyramid cut with 8 holes in the pyramid. The "baby-V buster" holes were eliminated. Two additional holes in the pyramid were expected to increase the depth of round broken.

**Conclusions.** 1. Fly-rock was still considerable, but damage to pipe and track was not as great as in Round 4. 2. The average depth of round broken was increased to 6½ ft. 3. The increased depth of round broken was attributed to the increase in the number of holes in the cut rather than to the elimination of

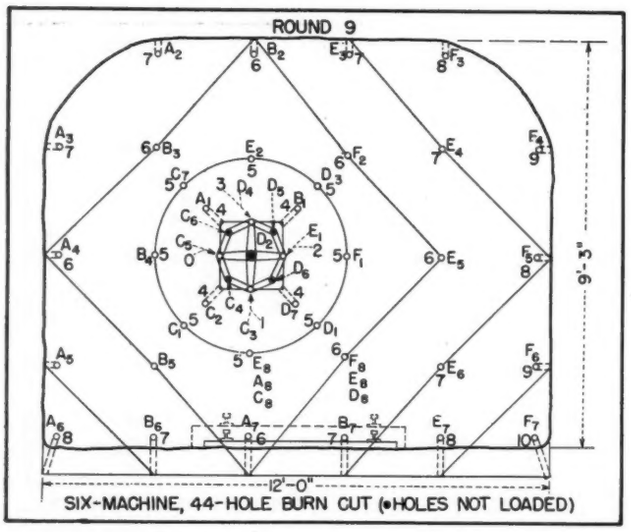


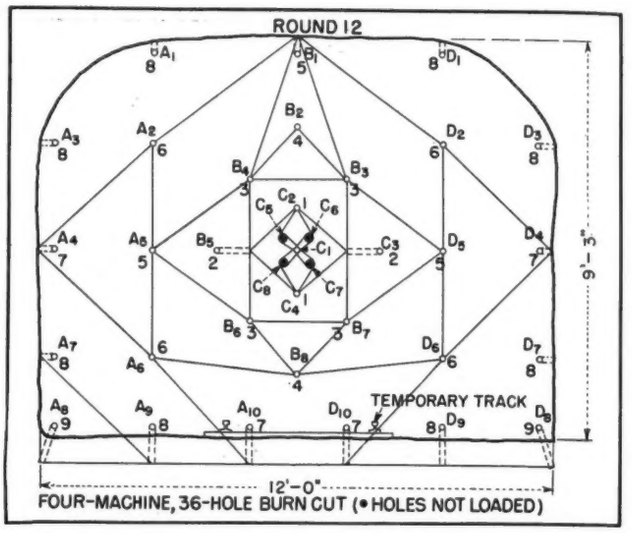
SIX-MACHINE, 42-HOLE PYRAMID CUT

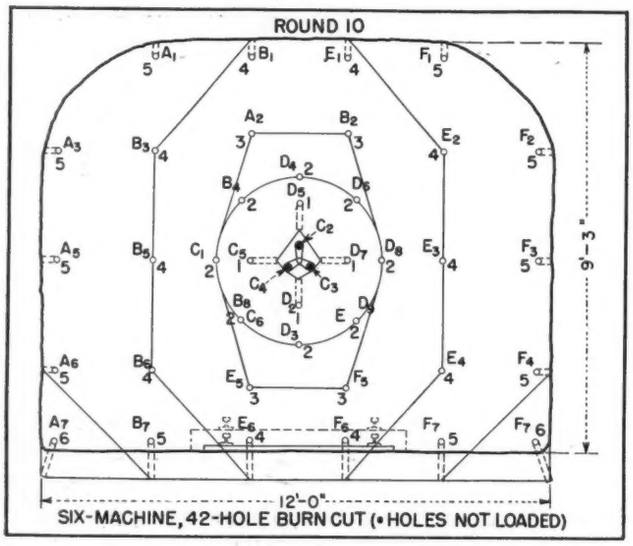
the "buster" holes. 4. Apparently some heretofore unobserved physical characteristic of Iroquois ground was responsible for the shorter depth of rounds broken than at Kearsarge. 5. An average depth of 6½ ft. was evidently the maximum in a 10x12 ft. drift in Iroquois ground using a pyramid cut or V-cut round. This type of round was a poor second to the burn-cut shaft round. Certainly, the difference in cross section of the shaft and of the drift could not account for the comparatively short depth of round broken in the drift. Something was wrong with blasting technique in previously tried burn-cut rounds. But what?

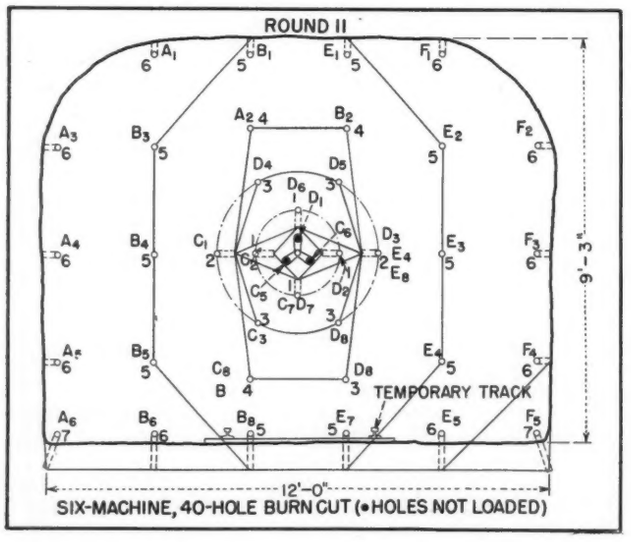
**Round 9.** To answer this question, burn-cut Round 9 was tried in the drift. Two additional "raker" holes were added to burn-cut Round 6. A combination of simultaneous "circle" blasting and simultaneous "square" blasting were substituted for the independent "triangle" blasting pattern of burn-cut Round 6. The number of holes was increased from 36 to 44. The reliever circle omitted in Round 6 was again used. Width of the drift was increased from 11 ft. to 12 ft.

**Conclusions.** 1. The round would not pull to bottom. The average depth of round broken did not exceed 5 ft. 2. The failure was not due to lack of holes or the blasting pattern, hence the round was considered to be a failure. 3. The failure was due to the action of the cut holes. 4. What was different about the action of the cut in the drift round from that in the shaft round? The action of the cut in the shaft round was studied by blasting each delay separately, then returning to the face to inspect the results. The burn circle pulled out as a plug in the shaft. The circle squeezed shut in the drift. The reason for this difference was that amygdaloidal cavities, which




were in greater abundance in the drift than in the shaft, collapsed and absorbed the force of the blast as the rock "flowed" into the cavities. The ground in the shaft, containing fewer cavities, acted in a brittle manner.

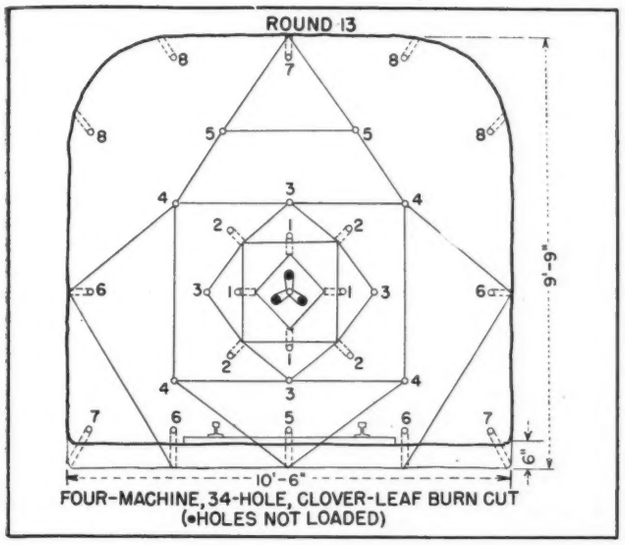
**Round 10.** This is a 42-hole, 6-machine clover-leaf burn designed to take advantage of the collapsing action of the amygdaloidal cavities and the expanding action of a hole drilled in "spongy" ground. The burn is arranged in the shape of a three-leaf clover, whence the name clover-leaf burn. The center pilot hole is drilled first, starting with a 1⅝-in. starter. Three large holes are drilled close to the pilot hole with a 2⅝-in. starting bit and arranged as shown. The distance between the side of the pilot hole and the sides of the clover-leaf holes is as close to 1½ in. as possible. The pilot hole is loaded to the collar. The clover-leaf holes are not loaded. The blast forces rock outward from the pilot hole into the three large clover-leaf holes. The space provided by drilling the clover-leaf holes 2⅝ in. in diameter is sufficient to take up the expansion due to creation of voids as the rock is shattered. If the 1½-in. spacing between pilot hole and clover-leaf holes is exceeded, the volume of broken rock will exceed the volume of the opening provided. Superior results are obtained in amygdaloid ground if the pilot hole is loaded with a comparatively low-velocity explosive. The lower the velocity at which the rock adjacent to the pilot hole moves into the clover-leaf holes, the less likely re-cementation is to take place. In brittle rock, re-cementation will not take place, so the velocity of the explosive used in blasting the pilot hole is not so important. If re-cementation occurs in "plastic-acting" rock, a free face is not developed by the burn holes, and the round does not break properly.

**Conclusions.** 1. The average depth of ground broken was increased to 8½ ft. In many cases, holes broke to bottom, leaving little or no visible "bootleg." Deeper rounds could probably be broken, but the depth of drilling was limited by the clearance in front of the drill jumbo for changing steel in the lifter holes. 2. Explosive consumption in the cut holes and the cost of explosives per round was reduced. 3. Fly-rock was practically eliminated. 4. The round was suitable for "brittle-acting" and "plastic-acting" ground, and was substituted to advantage in shaft sinking, raising, and chute cutting.

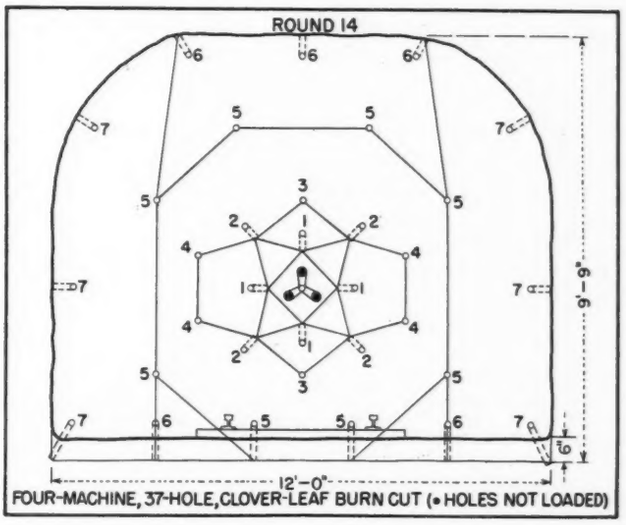
**Round 11.** Round 11 was developed from Round 10 by eliminating two holes from the reliever circle and modifying the blasting pattern. Drilling time and powder consumption were reduced slightly. The average depth broken per round was slightly less.

**Round 12.** Round 12 was designed for drilling with four machines instead of six as previously. Three back holes were used instead of four. Two "rakers" were used instead of four. A four-leaf-clover burn was tried in place of the three-leaf-clover burn. The blasting pattern was modified because of changes in the drill pattern.

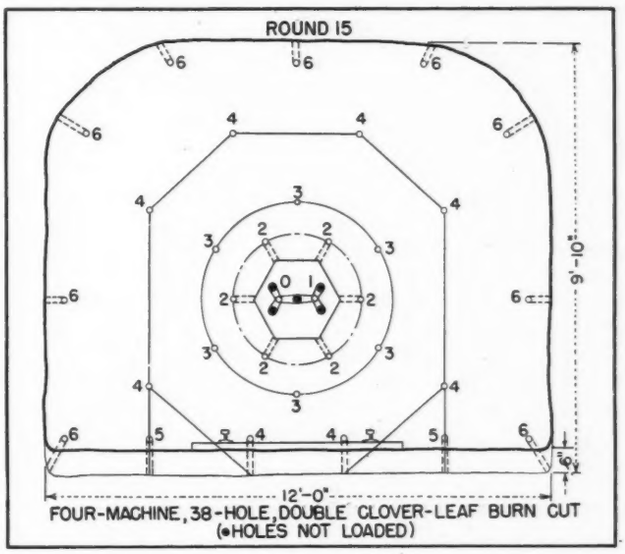
**Conclusions.** 1. The distance between the pilot hole and the clover-leaf holes was too great for best results. 2. The four-leaf clover did not help the action of the burn and was not superior to the three-leaf clover. 3. Drilling time was greater for the large holes than for the small holes. Drilling time for the C-machine, drilling eight holes including the clover-leaf holes,



FOUR-MACHINE, 34-HOLE, CLOVER-LEAF BURN CUT
(•HOLES NOT LOADED)



FOUR-MACHINE, 37-HOLE, CLOVER-LEAF BURN CUT (• HOLES NOT LOADED)



FOUR-MACHINE, 38-HOLE, DOUBLE CLOVER-LEAF BURN CUT
(•HOLES NOT LOADED)

was at times longer than for the A or D machines, which drilled 10 holes. 4. The blasting pattern did not provide uniform burden on all holes. This condition was not apparent to the miners, and thus could not be consistently compensated for during charging of holes. 5. Holes $C_2$ and $C_4$ were not particularly effective. Holes $B_5$ and $C_3$ were too widely spaced to be highly effective as "raker" holes. 6. The round should be redesigned, principally to improve the blasting pattern. 7. Reducing the drilling crew from six men to four reduced the rate of advance about 2 ft. per 24 hours, but reduced the cost of drifting appreciably.

**Round 13.** This is a three-leaf-clover burn with four raker holes. The width of the drift was reduced, assuming that the rate of advance would increase and that the cost per foot of drifting would decrease. The blasting pattern used in Round 12 was modified.

**Conclusions.** 1. The depth broken per round decreased. 2. The cost per foot of development work increased. 3. The smaller section was not as economical as the larger section, hence was abandoned.

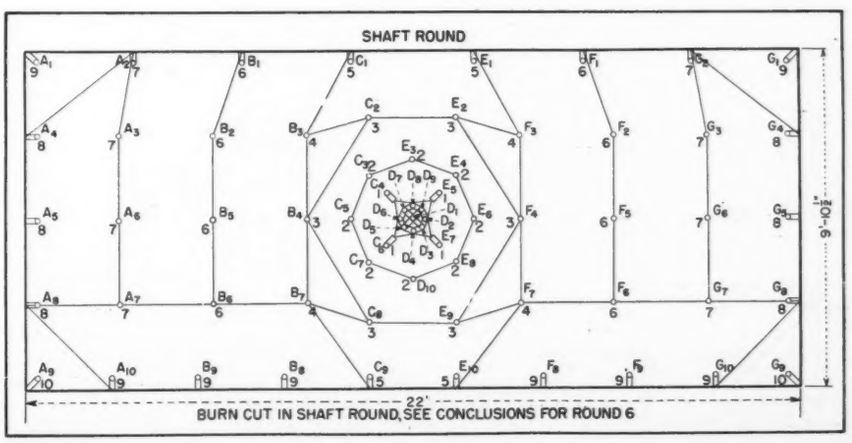
**Round 14.** This was the final round used in the drifting experiment. I consider it to be the best round tried in driving the 800 ft. of drift at Kearsarge and the roughly 5,000 ft. of drift at Iroquois. Holes are well spaced. A total of 37 holes, including the three clover-leaf holes, are used. The burden is progressively increased from the center of the round outward. The side holes, including the side lifters, are blasted last as slabbing holes. This results in a high muck pile which caves and runs into the bucket of the loading machine.

**Round 15.** Round 15 was designed at the close of the experimental period, but not tested. It is a double-clover-leaf, burn-cut round which may possibly pull rounds deeper than the single-clover-leaf burn-cut. The use of six rakers may increase fly-rock slightly, but will aid in pulling a deep cut.

Simultaneously blasting of the 38-hole round requires only seven different delays. Higher-delay detonators are more expensive than the lower-delay detonators. The drill pattern will probably result in a lower explosive cost per ton and a slightly coarser muck pile, but a high, well-placed muck pile which caves readily toward the mucking machine.

## ACKNOWLEDGMENTS

I wish to acknowledge the interest shown in this work by E. R. Lovell, formerly manager of operations, now president of the Calumet & Hecla Consolidated Copper Co., and to thank him for permission to publish this article. I also wish to acknowledge the assistance and cooperation of Sam Richards, superintendent of the Kearsage mine; Hogarth Penprase, mine captain, and William Langdon and Gordon Kingstrom, shift bosses, at the Iroquois mine; and Mr. Jeffries, of the Atlas Powder Co.



BURN CUT IN SHAFT ROUND, SEE CONCLUSIONS FOR ROUND 6

# Sampling Diamond Deposits In Southern Africa

**DRURY A. PIFER,** Associate in Mining Engineering, College of Mines, University of Washington, Seattle, Wash.

**Formerly in charge of the larger alluvial mines and the pipe mines at Kimberley for De Beers Consolidated, Mr. Pifer writes with authority. Some of the details outlined were devised by him. Aside from its intrinsic interest, the procedure described may suggest a technique for sampling deposits containing scattered minerals of value, including other precious stones, quartz crystal, and the like**

DIAMOND OCCURRENCES are of two general types—the primary, massive pipe deposits, volcanic in origin, and the secondary alluvial deposits of gravels found either in modern streams or in ancient river flats and benches, as well as in raised beaches along the coast. Diamond-bearing dikes also occur but are unimportant.

Sampling a pipe to control the mining grade or to check the yield is not considered necessary. The average diamond content of a pipe is remarkably constant, and with uniform mining and attention to dilution the day-to-day recovery varies little, this in spite of various irregularities that occur in the horizontal and vertical distribution of the stones.

In addition to various types of kimberlite, columns of magmatically stoped rubble occur in a pipe, usually near its perimeter or in constrictions if the pipe has an elongated shape. The diamond content of the rubble columns varies widely and is usually much less than that of the ordinary kinds of kimberlite. The decrease in the content is probably caused by dilution of the magmatic material with extraneous rubble.

**1. SAND DREDGE taking initial cut for stripping a sample trench on ground worked by the Consolidated Diamond Mines of South West Africa at the Orange River mouth, S.W.A.**

In an operating mine, sampling is done to establish ore-reserve limits on the boundaries of rubble columns which can be excluded from stoping. At rare intervals, when a new main level is opened, the whole area of a pipe may be sampled. The main-level interval is customarily 600 ft. A newly discovered pipe would be sampled completely on a regular pattern.

In preparation for sampling, a grid of tunnels is planned to cover the probable boundary of the reserve area. The tunnels are located on the frame of the standard development layout so that they may later be used for exploitation. The final development pattern is a rectangular grid of tunnels spaced on 22½-ft. centers. Sampling tunnels are laid out on that part of the grid which is nearest to being at right angles to the probable reserve boundary line; and they are spaced on 67½-ft. and 45-ft. centers. The spacing is varied according to local circumstances.

Large samples must be taken because of the nature of the deposit. The number of stones in any unit volume of ground is relatively small and varies from mine to mine. It has been estimated that the average distance between stones in Dutoitspan mines is more than 30 in., and the concentration ratio for kimberlite ores on a weight basis is of the order of one part to 20 million. In view of these considerations, the entire volume broken from the tunnels is taken to get a representative sample.

Tunnels are carried the standard mine size, 4½ ft. wide and 7 ft. high. The usual sample is not less than 25 16-cu. ft. cars. This quantity of broken ground is obtained from an advance of about 8 ft. The advance that is actually made and the location of each sample are measured from survey pegs by the sampler.

Blue ground breaks readily, and

the rounds are designed to break only 2 ft. Holes are lightly charged, and the rocks scattered by the blast are not appreciable beyond 12 ft. "Scatter" is partly stopped by accumulating a pile of ground in front of the face until the whole sample volume is broken. Then the tunnel is cleaned in one loading cycle.

Tunnel driving, loading, and transporting sample to treatment plant is in charge of a "technical assistant" who is present at all times and is responsible for correct performance. Labor is done by a gang of natives.

Samples are transported in ordinary, especially assigned mine cars, painted on both sides with the words "Test Ground" and the initials of the mine. Each car is tagged with the number of the sample.

A special washing unit is erected for the samples, and it is thoroughly cleaned out after each run. Diamonds are recovered on a grease table as in the ordinary process.

A check on the accuracy of sampling by comparing recovery against indicated content is impossible with the mining method used. However, a mining limit established by sampling on one sublevel is reaffirmed by the results of sampling a sublevel 100 ft. below. This is analogous to a check sample and indicates that the method does give reproducible results. With sample levels 100 ft. apart and tunnel centers 67½ ft. apart, the volumetric sample factor is 1/214, or 0.466 percent; on 45-ft. centers the factor is 1/143, or 0.700 percent.

## Alluvial Deposits

Raised beach deposits on the Atlantic coast of the Cape Province and South West Africa are systematically sampled either by pits or by continuous trenches. Trenching is considered better than pitting, as it gives more information and a more accurate sample. The trench profile gives a complete picture of a beach line, exposes the relations between barren and valuable strata, determines the distribution of diamonds in both vertical and horizontal extent across the whole beach, locates definitely the position of the ancient beach head beyond which diamonds are not usually found, and exposes a continuous section of bedrock.

A typical section of raised beach has a relatively thick accumulation of gravel along that portion immediately above former high-tide level, the result of storms casting material upon the beach just beyond reach of ordinary waves. Similar accumulations are observed on beaches of the nearby coast today. Landward, the gravel lens slopes steeply; on the seaward side, the slope is more gradual, but steeper than the average beach slope into which it grades. The normal wave action of spreading and leveling distributes gravels over the beach between high storm level and extreme low-tide level. The gravel stratum of the beach gradually diminishes in thickness toward deeper water until it thins out to few scattered pebbles and finally disappears. Characteristically, one beach overlays another, with the respective beach heads displaced by widths up to 100 ft. or more. In some instances the successive beach gravels rest directly on each other; in other cases a sand layer separates them.

Potholes in the bed rock are sometimes filled with gravel and sometimes with sand with or without diamonds.

2. SAMPLE CREW working in stripped trench. Coarse-gravel trommel in foreground; rotary pan for concentrating in center; sample section frames lying on trench.

## Trench Spacing

At the Orange River mouth, on the north side, the deposits are covered by dune sand to an average depth of 12 ft., the maximum being more than 30 ft. Initial prospecting was done with trenches which were irregular in spacing, direction, and length—factors that were controlled by the shape and position of the deepest hollows among the dunes, as the trenches were located in hollows to avoid digging overburden. When it became apparent that the deposit was large and continuous, trenches were laid out regularly.

Trenches are laid out at right angles to the general trend of the beaches, paralleling the existing shore. Approximately 25 of them had been spaced about 250 meters (820 ft.) apart, when analysis of the diamond content and the distribution from trench to trench indicated that a greater spacing would be satisfactory. The final spacing adopted is now 400 meters (1,312 ft.).

When an unexplored area is opened, primary trenches are excavated across its full width on 1,200-meter (3,936-ft.) centers. The general trend and boundaries of any beaches discovered are presumed to run in straight lines between the primary trenches. Secondary trenches are dug over the widths thus outlined. They are extended in both directions far enough beyond the disclosed beach gravels to assure closing off in barren ground. Two secondary trenches between primary trenches give the 400-meter final spacing.

South of the Orange River mouth, at Alexander Bay, trenches are spaced 1,000 ft. At Klein Zee, 85 miles farther south, trenches were spaced 600 ft. apart. This relatively close spacing was adopted because of the known erratic nature of the deposit as disclosed by earlier sampling and in exploitation. Trenches revealed the usual pattern of successive beach lines, in this case narrow, facts which had not been evident from earlier pit sampling on adjacent portions of the

**Comparison of Ratio of Sample Volume to Volume Deposit**

| Type of Deposit | Sampling | Spacing | Ratio |
|---|---|---|---|
| MARINE TERRACE | | | |
| Orange River Mouth | Trench | 250-m., center | 1/167 |
| Orange River Mouth | Trench | 400-m., center | 1/267 |
| Klein Zee | Trench | 600-ft., center | 1/200 |
| Klein Zee | Pits | 100-ft., squares | 1/416 |
| STREAM | | | |
| Angola, creek deposits | Pits | 100 x 30-m., center | 1/1500 |
| Angola, river flats | Pits | 50 x 30-m., center | 1/750 |
| PIPE MINE | | | |
| Kimberley, massive | Tunnel | 4½ x 7-ft., section | 1/214 |

deposit. A subsequent stream has disturbed the deposit in part, making interpretation from its data difficult.

## Locating Trenches and Sample Sections

Trenches are located accurately by survey, and a profile is made on the center line of the proposed trench. When sand overburden has to be removed first, its depth is measured at 25-meter intervals by driving pipes to the gravel surface. With the information thus obtained a stripping program is arranged to open a cut to within a few centimeters of the gravel. When this stripping is done, the center line of the sample trench is again laid out with instruments along the cut and the end of every fifth sample section is marked with numbered stakes. The longitudinal profile of the cut thus made is surveyed at the same time.

Stripping is done with mechanical shovels, the material being cast to one side of the cut. At Alexander Bay a conventional, dipper-bucket revolving shovel is used; at Orange River Mouth, S.W.A., a special, caterpillar-mounted sand dredge weighing about 100 tons is used. This has a digging arm carrying a wheel, 8 ft. in diameter, with buckets on its periphery. These discharge onto a conveyor belt on the digging boom which in turn discharges onto a stacker-boom conveyor. There is an individual motor drive for each moving unit, the dredge carrying a 100-kw.hr. diesel-electric generator. Stripping capacity with this excavator is more than 300 cu.m. per hour. An efficiency of 6.25 to 7.00 cu.m. per kw.-hr. is achieved.

Depth and width of cut taken in stripping a trench depend on the stacker length; the farther from the edge that the stacker can discharge, the higher the sand may be stacked before it runs back into the cut. The accompanying excavating schedule diagram pertains to a cut 1½ meters deep and 8 meters wide taken with dredges at Orange River Mouth. For deep work, part of a second cut can be stacked on the opposite side of the trench. To get space for deeper cuts, the spoil from one of the first two passes must be cast farther away from the trench by making a special pass with the excavator. For deep work, such rehandling leads to complicated excavating schedules. Trials are to be made with tractor-drawn combination excavator and carrier whenever equipment again becomes available.

Depth of overburden varies; so for convenience a trench is divided into longitudinal sections, each having overburden of a depth suitable for one schedule of cuts or passes. Trenches up to a mile in length have been dug, each divided into three or four sections.

## Digging Sample Sections

The sample section to be excavated is outlined on the ground by a frame of planks centered on the stakes previously set by the surveyor. Particular care is taken to dig the sample trench to exact width. This is measured at frequent intervals so that no under- and over-cutting is done. Falls of ground from the sides are excluded from the sample.

Trenches at Orange River Mouth are 1.5 meters (4.92 ft.) wide and each sample section is 5 meters (16.4 ft.) long. At Klein Zee the trenches were 3 ft. wide and sections 25 ft. long.

The ground excavated is thrown out of the trench with the shovel into a shallow box on the ground. This box runs the full length of the section, is about 9 in. deep, and is lined with light sheet metal. Boulders are hand-sorted in the trench and thrown to one side.

When a section is deep or its sides tend to cave, support is provided by heavy sheet-metal caisson rings. These are used in sets of five, each fitting inside a larger one. The largest is 2 meters in diameter, each being a meter high. Five sets are sufficient for two sample sections. A hand windlass is used when the depth is greater than shovel-throw.

Experience has shown that diamonds are not found in the same layers between the beach-gravel beds, and it is customary to cast such sand to one side without treatment. When sampling, the sands from every fifth section are washed, the rest being discarded. In a new area, even if it is contiguous to one that is well known, the entire content of each section would be washed until experience confirmed that the usual conditions existed. All of each gravel bed in the sections is washed, each stratum being handled separately so that there is no doubt as to the exact distribution of diamonds.

## Treament of Samples

Each crew has its own unit for concentrating the sample. Equipment used comprises two trommel screens, a field jig, and a sorting table. The trommels have wooden hexagonal frames, three meters long and 75 cm. across the inscribed diameter. The first trommel has an interior feed cone of punched plate with 15-mm. holes and is covered with 2-mm. brass cloth. The cone rejects coarse gravel, which is examined for diamonds before being discarded. Sand undersize from the 2-mm. screen is also thrown to waste, for it has been found that it contains no diamonds.

Gravel from the sand trommel is sized in the second trommel into three fractions: 15/10 mm.; 10/6 mm.; and 6/2 mm. It is then concentrated on a Plietz portable field jig, made locally and which uses little water. This has a hopper body filled with water in which is suspended a round sieve, this being a movable jig bed, hung by two arms from a rocker-arm shaft across the top of the machine. A feed cone discharges the gravel onto the center of the sieve. The frame of the latter forms a rim about 40 mm. above it. In operation, diamonds and other heavy minerals settle on the jig bed near the center where the feed enters. As the sieve fills, the light minerals wash over. A small bucket elevator lifts the tail-

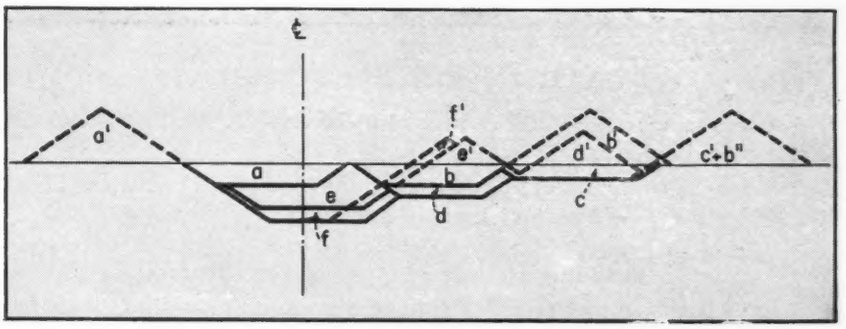
ings out of the hopper, the water draining back into the machine. When a reasonable amount of ground has been put through, the sieve is lifted out and turned upside down on a sorting table, and its contents are examined and sorted for diamonds.

## The Rotary Pan Used

Alternative to sizing and jigging equipment, the sample crew is often equipped with a hand-powered rotary pan, the traditional diamond-washing machine of the small worker. This is an annular trough about 2 ft. wide and 4½ to 5 ft. outside diameter. Above it, suspended from a central vertical shaft, is a spider having six arms carrying triangular bar teeth which dip into the trough to within ⅜ in. of the bottom. When the spider revolves, teeth on a following arm describe a circle just outside of the track of teeth on the preceding arm. Speed is 11 to 14 r.p.m. A broad face of each tooth is set to face slightly outward so that any particles it may strike are knocked into the path of the following tooth. Feed and water enter tangentially from a trough as its outer rim and tailing overflows the inner rim. The feed-water action is countercurrent to the action of the teeth and to the centrifugal force of the swirling mass in the pan. A crudely defined specific gravity is maintained by the operator and varied according to the appearance of the surface of the mixture. Heavy minerals, including diamonds, fall to the bottom and are carried to the outer rim by tooth action and centrifugal force; concentrate is drawn off at regular intervals and sorted.

The rotary pan is effective and, if not forced, will throw very few diamonds into the tailing. It will wash 300 to 400 cu. ft. of feed in an ordinary 8-hr. shift. The feed is usually passed through a 1-in. or ¾-in. screen. Water from the tailing discharge is bailed back into the feed launder, about 2 gal. per minute being required. The machine uses more water per unit of ground washed than the Plietz jig but has greater capacity. It is especially useful when the sample is too wet for efficient sand screening such as that required for treatment in a jig.

A separate report is made for each section excavated. Volume of gravel screened from each stratum is measured and recorded and the number of diamonds recovered is noted. The stones are handed in at the office daily, where they are weighed and credited to the sample and stratum indicated. After the section is excavated, the sampler measures and records the thickness of each stratum from the surface downward, at half a meter from the ends and at the center of the section, and sketches a picture of the profile on the back of his report.




**THE SCHEDULE** for disposing of the spoil when stripping before cutting a sample trench is shown by this sketch. It pertains to a cut 1½ meters deep and 8 meters wide.

From the surface and overburden trench profiles and the sampler's data a continuous profile is made of each trench. Diamonds found in a sample section are indicated on the profile drawing by a cross on the appropriate stratum at the section. Below the profile is a tabulation of diamond content. Data sheets for information from each section are kept for each trench.

## Quality Nearly Constant

The quality of diamond production from any one mine or alluvial field is nearly constant. The monetary value of diamonds recovered from sampling is not used as a factor in controlling exploitation, as the average value per carat of the production remains nearly constant for any one market level. Cut-off values are thus related to weight of content, which figure is used for control; i.e., carats per unit area or per unit volume.

Pit sampling has been used on beach deposits at Klein Zee. The pits are initially spaced on a square grid system at intersections 300 ft. apart in both directions. In favorable areas thus disclosed, secondary pits were spaced on the grid at 100-ft. intersections. Each pit covered an area of 27 sq.ft., a figure which simplified calculation to a cubic- or square-yard basis.

The sand overburden offered no problem, being only a few inches thick. The whole content of each pit was washed for the sample, and in mining the whole volume of the deposit is taken for ore. Methods of treatment were the same as described for trench sampling.

Beach gravels have an irregular trend and in some places are narrow, not exceeding 100 ft. Work with sample trenches subsequently has shown that the primary pit spacing of 300 ft. was too open and did not locate all of the deposits.

In Angola the diamondiferous deposits are in creek valley and terrace gravels and in river flats. Pit sampling is favored and has been in use for many years. On the creek deposit pit lines 100 m. (328 ft.) apart are run across the direction of stream flow. Pits are spaced 30 m. (98.4 ft.) apart on the lines. On the river-flat deposits the pit frequently is doubled by halving the distance between the pit lines. In both cases pits are circular and 1.6 m. (63 in.) in diameter, which gives an area of 2 sq.m. (21.65 sq.ft.).

Consideration of the several special elements in sampling diamond deposits and of the practice at different properties indicates that large bulk samples, as from tunnels or trenches, are necessary and that sample ratios on the order of 1/250 are required.

## Recovery Factors

As explained, no recovery factors are available for the underground mines. At one large alluvial mine sampled by trenches the factor was 0.87, but subsequent recleaning of worked-out areas brought the factor nearer to unity. At the same mine the gravel recovery factor was 1.7, the inflation being accounted for by the manner of estimating volume, which did not include the barren strata between gravel beaches. When this was taken into account the volume recovered was approximately unity.

## Ontario Report Recommends:

**1. Use of drums and head sheaves of diameters not less than 80 to 100 times rope diameter.**

**2. A program of systematic research in the field of desirable properties for rope wire to be incorporated into a standard specification.**

**3. Thorough investigation of means of corrosion prevention in mine hoisting ropes, including a study of types of rope dressing.**

**4. Encouragement of research into electromagnetic methods of hoisting-rope examination.**

**5. Investigation of the feasibility of incorporating electrical conductors in hoisting ropes for purposes of cage-to-surface communication and to provide automatic brake application in case of rope failure.**

**6. Development of improved safety devices to operate effectively against the influence of a trailing rope.**

**7. Appointment of competent engineers with mechanical experience to supervise (Department of Mines) inspections of hoisting equipment and recommend mechanical improvements.**

**8. Cooperative restudy of hoisting regulations by the Department and the mining industry.**

**Survey of Mining Progress**

(*Continued from page* 67)

Amplidyne control, together with a 13,200-volt motor-generator set, are special features of a new underground hoist, believed to be the largest in the United States, installed by Bunker Hill & Sullivan during the war. Drums are in tandem and are driven by two 600-hp. synchronous motors; rope speed is 1,500 fpm.; hoisting capacity is 2,000 tons per 16 hr. for a 6,000-ft. inclined lift (4,000 ft. vertically); and the net load is 10 tons.

The installation of amplidyne control on the hoist at the Mather iron mine, in Michigan, is already well known.

Hoisting speed can be regulated and the maximum torque limited with the Westinghouse Rototrol, which operates by controlling the excitation of the d.c. generators supplying the hoist motors. Results are: lowered maintenance costs, longer rope life with fewer shutdowns, less wear on mechanical parts, decreased commutator maintenance, protection of equipment against abuse, and less need of watching the indicators constantly.

Advantages observed in operating the Rototrol control installed on the main hoist of the Sunshine company, like the Bunker Hill, in northern Idaho, are listed by the chief engineer as: (1) maximum hoisting with minimum heating and mechanical strain; (2) positive predetermined acceleration, deceleration, and speed control, regardless of load; (3) simplicity; and (4) ability to use certain safety provisions not possible with former control, such as brake-interlocking switches, backout switches, and brake wear switches.

With either system, it is said, power consumption can be decreased, the risk of overloading and burning out of equipment reduced, and operating safety increased.

### Elevators for Pillars

Following the practice of installing man cages in pillars between stopes where the lift is high, as adopted by the Hudson Bay company at Flin Flon, a Southeastern mining company intends to install another pushbutton elevator (already having one underground) in a stope pillar where 400 ft. of back is to be mined with sublevels at 60-ft. intervals, this in connection with blast-hole diamond drilling. This is but another instance of the growing inclination to save the strength of workmen for the task for which they are hired, as well as to make the day's work less arduous physically, by reducing the amount of ladder climbing. Incidentally, the elevator saves time. The same idea is expected to find further application on the surface, in providing elevators in lofty headframes as done in the 197-ft. structure at the Mather iron mine, at Ishpeming, Michigan.

Standardization of hoisting practice is found advantageous where an operator has several shafts. One large company has completely standardized its compartment sizes, electrical equipment, hoisting ropes, cages and supply-cage hoists, and partially standardized its ore hoists and skips, this for its major shafts, all of which are vertical.

### For Safety in Hoisting

**Safeguards Against Cage Accidents.** Recommendations for improving safety in hoisting prepared by the non-industry committee that was appointed by Ontario's Minister of Mines to study the causes of the accidents in the Paymaster mine two years ago when a cage fell, killing 16 men, may be expected to influence the practice in shafts, if only because of the large number of companies that cooperated. An abstract of these recommendations is given at the left on this page.

Safety dogs designed to grip the track rails of the (inclined) shaft instead of wooden guides are used on a cage recently designed for a Colorado mine.

### Signaling Improved

Linked with considerations of safety is the matter of shaft-signaling. If this is to be foolproof, the cage tender must be able to signal the hoistman from the moving cage without interference by others. Circuits employing electronic devices are being used increasingly to this end.

Preformed rope, long preferred for slushing because of its flexibility and the fact that it does not fray when broken, is finding better acceptance for hoisting. The list of users is growing.

Head sheaves in need of regrooving, at the Homestake, in South Dakota, are regrooved in place by means of a jig mounted in the headframe. A South African mine does likewise.

An interesting detail is the remote-control system installed at the Shenandoah-Dives mine, in Colorado, to enable the hoistman to be lowered to the haulage level (on signal to the electrician below) for exit on week ends and subsequent return, thus saving a 1,750-ft. climb. During idle periods the company thus can save the hoistman's wages.

**Air conditioning and ventilation and other phases of underground mining will be discussed in Part III, to appear in April.**

# MARKETS—Trends and Prices

## Strong Situation in Copper as February Ends—Lead Advanced to 14c., New York

**Government officials ruled late in February that RFC (Metals Reserve) stocks of copper acquired this year, dutiable at 4c. per pound, will be sold at cost plus duty or at the market price, whichever is the higher. The cost figure was placed at 21½c., Valley. This development caused most sellers to meet the advance early in March. The Government will release from 30,000 to 35,000 tons of copper at the higher level for March allocation.**

WITH DEMAND FOR MOST non-ferrous metals on an abnormally high plane throughout February, and the supply outlook in some items obscured because transition from governmental participation in the distribution of scarce materials to private operation had not yet been completed, the general price situation as the month ended favored sellers. Copper suffered most in these circumstances, owing to uncertainty over availability of March metal from the Office of Metals Reserve in quantity. The 4c. import tax entered into this particular problem. Higher prices obtained late in the month for foreign copper, lead, silver, cadmium, and bismuth. Quicksilver was quiet, and declined $2 per flask.

The E.&M.J. index of non-ferrous metal prices for February did not reflect the upturn in prices, largely because the monthly average for silver was lower than in the preceding month. Our index for February was 140.42, against 140.88 in January. A year ago, under price control, the index number was 96.42. (100 is the composite for 1922-3-4).

In spite of pressure from consumers of copper for the temporary waiving of the import tax, nothing definite was done about the matter up to the time the month ended, and the market was in a state of general confusion over the price situation. RFC did announce, late on Feb. 28, that it will sell copper imported this year on the basis of cost, plus duty, plus freight and handling charges, which would be the equivalent of 21½c. per pound, Valley. In the event that the market should rise above this basis the selling would take place "at the prevailing price on date of shipment."

The January statistics of the fabricating division of the copper industry placed consumption for the month at 139,263 tons, a new peacetime high. This compares with 124,432 tons (revised) consumed in December. Domestic production of refined copper in January totaled 80,144 tons, against 69,008 tons in the corresponding month a year ago. Out of total deliveries of copper to domestic consumers in January, which amounted to 143,692 tons, the Office of Metals Reserve supplied 59,396 tons. Deliveries in February are expected to be smaller, chiefly because the Government may not release much more than 33,000 tons from its stocks.

Though most of the copper sold during February in the domestic market was disposed of on the basis of 19½c., Valley, the American Smelting & Refining Co. continued to do business on the 20½c. basis, which is reflected in the movement of prices that occurred daily throughout the month.

Several domestic consumers, concerned over a possible severe shortage in supplies, purchased foreign copper, thereby creating an even tighter situation in the market outside of the United States. In some instances the equivalent of 21c. f.a.s. New York was paid. Undoubtedly, much of this metal is intended for use in manufactured goods for export and the drawback privileges covering the duty would apply.

The price of lead advanced 1c. per pound on Feb. 25, establishing the quotation at 14c., New York, a new all-time high. In announcing the rise in lead, the American Smelting & Refining Co. said:

"Lead prices in the world market have advanced to the equivalent of the new domestic price when allowance is made for transportation costs and the United States import duty of 1.0625c. a pound. It is understood that there have been sales by others in the domestic market of imported primary lead at prices substantially above the new 14c. price."

The higher market is expected to bring out more lead from various sources, particularly scrap. Production of lead from scrap has been increasing since the beginning of the year.

Preliminary estimates place total deliveries of refined lead to domestic consumers in January at approximately 65,000 tons. The Government contributed 7,000 tons from its stocks.

A spectacular reversal in the price trend occurred in silver. After holding at 70¾c. an ounce during the first 14 days of February, buying volume from domestic and foreign sources increased appreciably and the market rose

### United States Copper Statistics

A summary of the United States copper statistics as reported by members of the Copper Institute, in tons, follows:

| | Production | | Deliveries to Consumers | | | Refined |
|---|---|---|---|---|---|---|
| | (a) Crude | Refined | (b) Domestic | Export | Total | (c) Stocks |
| 1941 ..... | 1,016,996 | 1,065,667 | 1,545,541 | 307 | 1,545,848 | 75,564 |
| 1942 ..... | 1,152,344 | 1,135,708 | 1,635,236 | ... | 1,635,236 | 65,309 |
| 1943 ..... | 1,194,699 | 1,206,871 | 1,643,677 | ... | 1,643,677 | 52,121 |
| 1944 ..... | 1,056,180 | 1,098,788 | 1,636,295 | ... | 1,636,295 | 66,780 |
| 1945 ..... | 841,667 | 843,113 | 1,517,842 | ... | 1,517,842 | 76,512 |
| 1946: | | | | | | |
| January ... | 58,178 | 69,008 | 115,601 | ... | 115,601 | 72,799 |
| February .. | 41,667 | 49,923 | 86,089 | 909 | 86,998 | 74,339 |
| March ..... | 41,832 | 20,139 | 58,590 | ... | 58,590 | 70,249 |
| April ..... | 29,280 | 18,989 | 75,756 | ... | 75,756 | 65,448 |
| May ..... | 31,897 | 20,551 | 93,647 | ... | 93,647 | 75,754 |
| June ..... | 32,785 | 23,870 | 95,267 | ... | 95,267 | 79,145 |
| July ..... | 56,906 | 43,606 | 97,527 | ... | 97,527 | 101,183 |
| August .... | 64,462 | 59,591 | 118,381 | ... | 118,381 | 94,669 |
| September . | 69,748 | 67,803 | 113,158 | ... | 113,158 | 98,619 |
| October ... | 72,807 | 77,947 | 136,481 | ... | 136,481 | 91,161 |
| November . | 73,024 | 75,066 | 129,206 | ... | 129,206 | 90,896 |
| December . | 78,674 (d) | 77,578 | 141,218 (d) | ... | 141,218 (d) | 80,832 |
| Totals ... | 651,260 (d) | 604,071 | 1,260,921 (d) | 909 | 1,261,830 (d) | ..... |
| 1947: | | | | | | |
| January ... | 79,341 | 80,144 | 143,692 | ... | 143,692 | 76,680 |

(a) Mine or smelter production or shipments, and custom intake including scrap. (b) Beginning March, 1941, includes deliveries of foreign copper for domestic consumption. (c) At refineries, on consignment, and in Exchange warehouses, but not including consumers' stocks at their plants or warehouses. (d) Corrected.

# MARKETS—Trends and Prices

sharply, settling at 80¼c. Excitement was high when it became known that silver was purchased here in a three-cornered deal for Indian account. Because of exchange controls, representatives of Indian buyers could not obtain dollars with which to buy silver in this market. Operating through Belgian interests, who exchanged blocked sterling for dollars, at a profit, London silver merchants were able to purchase the metal rather freely. It was estimated that such transactions involved more than 9,000,000 oz. The trade was speculating whether the British and Indian authorities will step in to stop the leak in exchange operations.

Zinc was in steady demand, but most operators appeared satisfied with the current price level. Demand was chiefly for Prime Western and Special High Grade, with both grades still in a tight position. The industry has been following production trends outside of the United States rather closely, believing that competition from foreign sources is likely to increase in the near future. Domestic smelters produced 72,332 tons of slab zinc in January, against 70,176 tons (revised) in December. Shipments in January totaled 74,795 tons, and stocks at the end of the month totaled 173,337 tons, against 175,800 tons a month previous.

Discussions in reference to obtaining Bolivian tin concentrates for 1947 brought out that producers are holding out for 76c. per pound of tin contained, f.o.b. South American ports, plus a revision in smelting charges, with authorities here opposed to meeting all of these demands. The domestic market for tin was unchanged, the quotation holding on the basis of 70c. per pound for "Grade A."

Quicksilver was unsettled, and the price declined to $86 per flask, New York. Domestic production for 1946 was estimated by the Bureau of Mines at 25,200 flasks; general imports came to 23,062 flasks; exports 907 flasks; and consumption 30,800 flasks. The fact that the Cartel offered metal at around $86, duty paid, caused consumers to take the view that supplies in sight are more than ample.

## Major Metals

### U.S. DAILY AND AVERAGE PRICES

| 1947 Feb. | Electrolytic Copper: Domestic (a) Refinery | Electrolytic Copper: Export (b) Refinery | Straits Tin: New York | Lead: New York | Lead: St. Louis | Zinc: East St. Louis |
|---|---|---|---|---|---|---|
| 1 | 19.225 | 20.025 | 70.000 | 13.000 | 12.800 | 10.500 |
| 3 | 19.325 | 20.100 | 70.000 | 13.000 | 12.800 | 10.500 |
| 4 | 19.375 | 20.025 | 70.000 | 13.000 | 12.800 | 10.500 |
| 5 | 19.325 | 20.025 | 70.000 | 13.000 | 12.800 | 10.500 |
| 6 | 19.450 | 20.300 | 70.000 | 13.000 | 12.800 | 10.500 |
| 7 | 19.400 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 8 | 19.225 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 10 | 19.475 | 20.300 | 70.000 | 13.000 | 12.800 | 10.500 |
| 11 | 19.325 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 12 | Holiday | 20.425 | Holiday | Holiday | Holiday | Holiday |
| 13 | 19.400 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 14 | 19.325 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 15 | 19.225 | 20.525 | 70.000 | 13.000 | 12.800 | 10.500 |
| 17 | 19.325 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 18 | 19.400 | 20.450 | 70.000 | 13.000 | 12.800 | 10.500 |
| 19 | 19.425 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 20 | 19.350 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 21 | 19.425 | 20.425 | 70.000 | 13.000 | 12.800 | 10.500 |
| 22 | Holiday | 20.425 | Holiday | Holiday | Holiday | Holiday |
| 24 | 19.275 | 20.675 | 70.000 | 13.000 | 12.800 | 10.500 |
| 25 | 19.400 | 20.550 | 70.000 | 14.000 | 13.800 | 10.500 |
| 26 | 19.325 | 20.675 | 70.000 | 14.000 | 13.800 | 10.500 |
| 27 | 19.450 | 20.675 | 70.000 | 14.000 | 13.800 | 10.500 |
| 28 | 19.225 | 20.675 | 70.000 | 14.000 | 13.800 | 10.500 |
| **AVERAGES FOR MONTH** | | | | | | |
| Feb. | 19.349 | 20.403 | 70.000 | 13.182 | 12.982 | 10.500 |
| **AVERAGES FOR WEEK** | | | | | | |
| Feb. | | | | | | |
| 5 | 19.342 | 20.038 | 70.000 | 13.000 | 12.800 | 10.500 |
| 12 | 19.375 | 20.383 | 70.000 | 13.000 | 12.800 | 10.500 |
| 19 | 19.350 | 20.446 | 70.000 | 13.000 | 12.800 | 10.500 |
| 26 | 19.355 | 20.529 | 70.000 | 13.400 | 13.200 | 10.500 |
| **CALENDAR WEEK AVERAGES** | | | | | | |
| Feb. | | | | | | |
| 1 | 19.421 | 20.038 | 70.000 | 13.000 | 12.800 | 10.500 |
| 8 | 19.350 | 20.217 | 70.000 | 13.000 | 12.800 | 10.500 |
| 15 | 19.350 | 20.421 | 70.000 | 13.000 | 12.800 | 10.500 |
| 22 | 19.385 | 20.429 | 70.000 | 13.000 | 12.800 | 10.500 |

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(*a*) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.275c. per pound, the average differential for freight and delivery charges.

(*b*) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead.

## Silver, Gold and Sterling

### DAILY AND AVERAGE PRICES

| 1947 Feb. | Sterling Exchange "Checks" | Silver (c) New York | Silver (c) London | Gold London | Gold (d) United States |
|---|---|---|---|---|---|
| 1 | 402.750 | (e) | (e) | (e) | $35.00 |
| 3 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 4 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 5 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 6 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 7 | 402.500 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 8 | 402.750 | (e) | (e) | (e) | 35.00 |
| 10 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 11 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 12 | Holiday | Holiday | 44d. | 172s. 3d. | 35.00 |
| 13 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 14 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 15 | 402.500 | (e) | (e) | (e) | 35.00 |
| 17 | 402.500 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 18 | 402.750 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 19 | 402.500 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 20 | 402.500 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 21 | 402.500 | 70.750 | 44d. | 172s. 3d. | 35.00 |
| 22 | Holiday | Holiday | (e) | (e) | 35.00 |
| 24 | 402.500 | 73.750 | 44d. | 172s. 3d. | 35.00 |
| 25 | 402.500 | 75.750 | 46d. | 172s. 3d. | 35.00 |
| 26 | 402.500 | 75.750 | 46d. | 172s. 3d. | 35.00 |
| 27 | 402.500 | 78.250 | 46d. | 172s. 3d. | 35.00 |
| 28 | 402.500 | 80.250 | 47½d. | 172s. 3d. | 35.00 |
| **AVERAGES FOR MONTH** | | | | | |
| Feb. | 402.625 | 72.329 | 44.475 | — | — |
| **AVERAGES FOR WEEK** | | | | | |
| Feb. | | | | | |
| 5 | 402.750 | 70.750 | — | — | — |
| 12 | 402.700 | 70.750 | — | — | — |
| 19 | 402.625 | 70.750 | — | — | — |
| 26 | 402.500 | 73.350 | — | — | — |

Calendar week averages, New York Silver: Feb. 1st, 70.750; 8th, 70.750; 15th, 70.750; 22nd, 70.750.

(e) Not quoted (Saturday).

(*c*) Determined by Handy & Harman on the basis of market prices for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(*d*) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

# MARKETS—Trends and Prices

## E. & M. J. Weighted Index of Non-Ferrous Metal Prices

100 is composite for 1922-3-4. (Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum)

| | | | |
|---|---|---|---|
| 1937 | 90.86 | 1942 | 86.80 |
| 1938 | 73.67 | 1943 | 88.74 |
| 1939 | 77.71 | 1944 | 88.74 |
| 1940 | 79.22 | 1945 | 90.86 |
| 1941 | 83.49 | 1946 | 110.057 |

| | 1945 | 1946 | 1947 |
|---|---|---|---|
| January | 88.74 | 96.42 | 140.88 |
| February | 88.74 | 96.42 | 140.42 |
| March | 88.74 | 96.42 | ..... |
| April | 88.74 | 96.42 | ..... |
| May | 88.74 | 96.42 | ..... |
| June | 88.74 | 107.16 | ..... |
| July | 88.74 | 117.11 | ..... |
| August | 88.74 | 113.32 | ..... |
| September | 91.16 | 113.32 | ..... |
| October | 96.40 | 114.25 | ..... |
| November | 96.42 | 131.23 | ..... |
| December | 96.42 | 142.19 | ..... |

## Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for January and February:

| | Jan. | Feb. |
|---|---|---|
| Quicksilver, N. Y. flask | 88.000 | 86.864 |
| Antimony (a) | 29.591 | 31.190 |
| Antimony, bulk, Laredo | 28.250 | 28.250 |
| Antimonly, in cases, Laredo | 28.625 | 28.625 |
| Antimony, Chinese (b) | Nom'l | Nom'l |
| Platinum, oz. troy | 57.038 | 58.000 |
| Cadmium (c) | 150.000 | 161.364 |
| Cadmium (d) | 152.500 | 163.864 |
| Cadmium (e) | 155.000 | 166.364 |
| Aluminum ingot | 15.000 | 15.000 |
| Magnesium | 20.500 | 20.500 |

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

## Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major non-ferrous metals. Prevailing prices for consumers in the United Kingdom, effective Jan. 1, 1947, follow:

| | Per Long Ton £ | s. | d. |
|---|---|---|---|
| **COPPER:** | | | |
| Electrolytic, high conductivity | 127 | 0 | 0 |
| Fire refined, high conductivity | 127 | 0 | 0 |
| Fire refined, high grade | 126 | 10 | 0 |
| Fire refined, min. 99.2 percent | 125 | 10 | 0 |
| Fire refined, min. 99.7 | 126 | 0 | 0 |
| Hot rolled black wire rods | 132 | 0 | 0 |
| **LEAD:** | | | |
| Soft, foreign, duty paid | 70 | 0 | 0 |
| Soft, Empire | 70 | 0 | 0 |
| English refined | 71 | 10 | 0 |
| **ZINC:** | | | |
| Foreign (G.o.b.), duty paid | 70 | 0 | 0 |
| Domestic (G.o.b.) | 70 | 0 | 0 |
| Prime Western and debased | 70 | 0 | 0 |
| Refined and electrolytic | 70 | 15 | 0 |
| Minimum 99.99 percent | 72 | 5 | 0 |
| **TIN:** | | | |
| Ingot, 99 percent | 380 | 10 | 0 |

# Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

### MISCELLANEOUS METALS

(February 28, 1947)

| | |
|---|---|
| Aluminum, ingot, 99 plus percent, lb. | 15c. |
| Antimony, domestic, spot, lb., 5 tons or more, in cases | 31.190c |
| Bismuth, ton lots, lb. | $2.00 |
| Cadmium, commercial sticks, lb. | $1.75 |
| Calcium, lb. ton lots, 97 @ 98 percent, cast | $1.85 |
| Chromium, 97 percent grade, lb. | 89c. |
| Cobalt, 97 to 99 percent, per lb. | $1.50 |
| Indium, troy oz. | $2.25 |
| Nickel, electrolytic cathodes, lb. | 35c. |
| Magnesium, 99.8 percent, carloads, lb. | 20½c. |
| Palladium, troy oz. | $24.00 |
| Platinum (Official quotation wholesale lots) troy oz. | $58.00 |
| Quicksilver, flask of 76 lb., 25 flasks or more | $86.00 |
| Selenium, 99.5 percent, lb. | $1.75 |
| Silicon, minimum 97 percent, spot, carloads, lb. | 14.75c. |
| Tellurium, lb. | $1.75 nom. |
| Thallium, 100 lb. or more, lb. | $20.00 |
| Titanium, 96 to 98 percent, lb. | $5.00 |

### METALLIC ORES

| | |
|---|---|
| Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit | $10.00@$12.00 |
| Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% $Cr_2O_3$, 2.8 to 1 ratio (Prices nominal) | $36.00@$37.00 |
| 48% $Cr_2O_3$, 3 to 1 ratio | $38.00@$39.00 |
| Iron Ore, Lake Superior, Lower Lake ports, long ton: | |
| Old Range bessemer | $5.45 |
| Mesabi bessemer | $5.20 |
| Old Range non-bessemer | $5.30 |
| Mesabi, non-bessemer | $5.05 |
| Lead (Galena) 80 percent, Joplin, Mo., ton | $166.85 |
| Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 percent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo. (Current prices in open market nominal at 69@70c. per long-ton unit.) | |
| Molybdenum Ore, 90%, per lb. of $MoS_2$ f.o.b. mines | 45c. |
| Tungsten Ore, per unit of $WO_3$: | |
| Foreign, 60 percent, duty paid | $22.00 |
| Domestic, scheelite, 60 percent and upward | $24.00 |
| Vanadium Ore, per lb. of contained $V_2O_5$ f.o.b. mines | 27½c. |
| Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton | $64.00 |

### METALLIC COMPOUNDS

| | |
|---|---|
| Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots | 6c. |
| Cobalt Oxide, 70 to 71 percent, lb. | $1.06 |
| Copper Sulphate, 100 lb. | $7.10 |

### ALLOYS

| | |
|---|---|
| Beryllium Copper, 2.5 to 3 percent Be, per lb. of contained Be | $14.75 |
| Ferrochrome, 65 to 70 percent, per lb. of Cr contained | 15.60c. |
| Ferromanganese, 78 to 82 percent, gross ton | $135.00 |
| Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo contained | 95c. |
| Ferrosilicon, 50 percent, per lb. of contained Si | 7.45c. |
| Ferrotungsten, 75 to 80 percent, lb. of W contained | $1.98 |
| Ferrovanadium, per lb. of V delivered | $2.70@$2.90 |
| Silicomanganese, 1 percent C, gross ton | $138.00 |

### NON-METALLIC MINERALS

| | |
|---|---|
| Asbestos, f.o.b. Canada (Quebec) mines (U.S funds), ton: | |
| Crude No. 1 | $650@$758 |
| Crude No. 2 | $165@$385 |
| Spinning fibers | $124@$233 |
| Paper stock | $44@$49.50 |
| Shorts | $14.50@$26.50 |
| Vermont, f.o.b. Hyde Park: | |
| Shingle stock | $62.50@$65.00 |
| Paper stock | $44.00@$53.00 |
| Shorts | $14.50@$28.50 |
| Floats | $19.50 |
| Barytes, f.o.b. mines: | |
| Georgia, crude, per long ton | $8.50@$9.00 |
| Missouri, 93 to 94 percent $BaSO_4$, per short ton | $8.25@$8.50 |
| Bauxite, long ton: | |
| Domestic, crude, 50 to 52 percent (not dried) | $5.00 |
| Domestic, chemical, 55 to 58 percent | $7.50@$8.50 |
| Domestic, abrasive, 80 to 84 percent | $16.50 |
| China Clay, f.o.b. mines, ton: | |
| South Carolina and Georgia, No. 1, bulk | $6.75@$8.00 |
| Delaware, No. 1 | $15.00 |
| Feldspar, bulk ton: | |
| Potash feldspar, 200 mesh | $17.00 |
| Glass spar, white, 20 mesh | $11.75 |
| Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 70 percent, all rail movement, ton | $33.00 |
| Acid 98 and 1 percent, bulk, ton | $37.00 |
| Fuller's earth, f.o.b. Georgia or Florida, ton | $7.00@$14.00 |
| Magnesite, per ton dead-burned, f.o.b. Washington | $22.00 |
| Mica: Domestic producers quote on punch and sheet as follows: Punch, 22c. per pound; 1½x2 inch, $1.10; 2x2 inch, $1.60; 2x3 inch, $2.10; 3x3 inch, $2.75; 3x4 inch, $3.50; 3x5 inch, $4; 4x6 inch, $5. Wet ground, very fine, $90 per ton. Special grades command premium. Bulk sales dry ground, $32.50 per ton. Scrap, $28 per ton and up. | |
| Ocher, Georgia, ton | $19.00@$22.00 |
| Pyrites, Spanish, per long ton unit of S, c i f, Atlantic ports | 12c. nom. |
| Silica, in bags, 325 mesh, ton | $20.00@$40.00 |
| Sulphur, Texas, mines, long ton | $16.00 |
| Talc, f.o.b. works, ton: | |
| New York, double air-floated, 325 mesh | $12.00@$15.00 |
| Vermont, extra white, 200 mesh | $9.50@$10.50 |
| Tripoli, Missouri, ton: | |
| 40 mesh, cream colored | $14.50 |

### IRON AND STEEL

| | |
|---|---|
| Pig Iron, Valley furnaces, gross ton: Basic | $28.00 |
| Steel, base price, Pittsburgh Billets, gross ton | $39.00 |
| Structural shapes, 100 lb. | $2.35 |

# WASHINGTON REFLECTIONS

*McGRAW-HILL WASHINGTON NEWS BUREAU*

## Department of the Interior Annual Report Betrays a Strong Leftist Influence

An old pipe-dream by Ickes' socialistic cohorts on what the Interior Department could do if it were to be given all the money it wants for development of domestic resources has turned up in the summary of this year's report of the Department.

The 50-page introduction to the annual report of Secretary Krug, entitled "Our Problems and Programs," is projected as a summary of intra-departmental thinking on conservation of natural resources. Actually, it is far from it. The individual Bureau of Mines and Geological Survey reports, buried in the 450-page volume, reflect a different and more realistic viewpoint. However, by the time the average reader has assimilated the double-talk in the first section, he hasn't any inclination to read further. The reaction in industry, and in the Department itself, has been all bad.

The first statement which startles the reader explains "the marginal metal mines presented a conservation problem which has been temporarily taken care of by the Stockpiling Act which provides for a continuation of wartime aid to them." If this is so, then the Army-Navy Munitions Board is greatly in error.

Probably the most ridiculous statement in the report is one which urges an inventory and price-tagging of all domestic mineral deposits:

"This inventory job may cost a billion dollars, and would normally take 20 years to complete. It could be speeded up, however. At any rate, we would know what we have, and what it is worth. We would know also the degree of our actual dependence on foreign sources, the possibilities for a continued flourishing mining industry in this country, and possibly also the point at which substitutions of one mineral for another and of plastics for specific minerals can be expected to become important factors in our economy."

The report leads up to the inventory idea by emphasizing the depletion of domestic mineral reserves, and by stating "The mineral agencies of the Government (Geological Survey and Bureau of Mines) have worked out a series of approaches to the basic problem of assuring some continued national basis for our mineral and metal economy. The first of these steps is an inventory job on a national scale. It involves intensive work in discovery and examination of whatever mineral resources we may still have. The new geophysical methods, where they are applicable to minerals, will also be used.". . .

"In addition to basic mapping, some further work has to be done on the background of badly needed minerals so that we will know where to start looking. It involves securing data on reserves which mining companies have not yet made available to the Government, partly for fear of taxation by the several states which tax declared reserves in the ground rather than production only. It will involve drill-testing of many ore bodies. Above all, it involves putting cost tags on our resources, and making these cost tags take into account all the possible economies that can be obtained from newer mining and processing methods and from lower cost energy."

Following the appeal for a billion dollars, Undersecretary Oscar Chapman is quoted as follows: "It is the hope of the Interior Department that new processes can be developed to bring into production low-grade domestic ores. We want to aid in doing that as much as possible, since otherwise large mining sections of this nation will shut down, and the impact on the states and areas directly concerned will be disastrous locally, and will spread out over the rest of the nation. We have no desire to hasten the increase of foreign minerals except in the form of stockpiles for security purposes. At the same time we find it desirable to have sufficient foreign imports to allow our manufacturing industry to be kept operating on an economic basis as long as possible."

Mr. Chapman then seeks to frighten Middle Westerners with the thought that depletion of domestic minerals will force a shift of metal-fabricating industry to seaboard areas, and concludes with a masterpiece of double-talk: "The Department of the Interior has always favored a widespread mineral development of domestic resources. The mining industry is the basic industry in many of our Western states. I would be reluctant to see developments that would shut off that industry but this [St. Lawrence] seaway, with a maximum importation of 8,000,000 tons, of which only a small part will probably be used for minerals, will not result in any such shutdown. On the contrary, it will help the Western and Middle Western mining states to the exact extent that it helps keep the metal industry of the lake area just where it is now, close to the domestic sources of minerals."

The report proceeds: "The third part of the approach to a solution of the nation's metal mystery is somewhat more audacious. It is that of adding values to our low-grade minerals by finding an entirely new use for them.". . .

After pointing to two examples, uranium and the well-worn electrolytic manganese, the report states, "The finding of a new use pattern is the missing part of this approach, and may be the essential requirement for the expansion of some of our non-industrialized regions.

"The fourth approach has been taken by the Congress. It is that of authorizing continued subsidy payments to high-cost mineral producers and stockpiling minerals for possible war needs."

In this last statement, the Department quite clearly implies its endorsement of permanent subsidy payments, which Congress, incidentally, has continued only until next July.

Speaking of public lands, the report states, "The Department's conviction that metallic minerals on the public domain as well as oil, coal and potash should be leased rather than be taken over in fee simple has for some years met the opposition of the mining industry. The mineral and land agencies of the Department believe that the public domain is public property and that the national mineral situation is serious enough to demand that some supervision be exercised over the timing of mineral production. They also believe that some royalty should be paid into the public treasury on wealth located on and produced from the public domain. The industry generally believes that the hazards of prospecting and costs are already sufficiently high, and that the addition of payments on production is one straw too many and holds back development. Some plan that would allow a basic net income after all costs and taxes and would provide for graduated royalties thereafter, might make the leasing proposals for minerals more acceptable to those small operators who would settle for a reasonable income instead of a killing."

The socialistic tone, the double-talk, and the apparent dismissal of the Bureau and Survey approach to mineral problems in the report introduction has led many of the "little people" in the department to believe that they are being "double-crossed" by the old gang in the Secretary's office.

Reaction in the mining industry, particularly in the West, indicates that this report has thoroughly upset whatever confidence Secretary Krug has been able to establish by personal appearances and public utterances.

## Copper Shortage Evokes Congressional Debate

A Congressional stalemate on the problem of boosting copper imports through temporary modification or elimination of the tariff, in the face of a squeeze in the domestic supply, is prompting consumer industries to drive for immediate action.

At present the country is faced with a shortage of between 30,000 and 40,000 tons a month. Domestic production of refined copper has increased to 80,000 tons a month; demands of buyers call for between 130,000 and 140,000 tons a month; actual consumption is estimated at between 120,000 and 130,000 tons a month.

As February ended, the Government owned hardly more than 65,000 tons of copper, made up of copper on hand, yet to arrive, and in process. The supply of duty-free copper is estimated at less than 10,000 tons, of which not more than 7,500 will be available for "hardship" cases in March. Most of the tonnage consists of dutiable metal that cost in the neighborhood of 21½c., duty included.

The price-tariff condition, now before Congress, makes private importation of copper difficult, except at higher prices. The world price, plus shipping charges and the 4c. duty, is equivalent to 25c. a pound.

The National Rural Electrification Cooperatives Association, representing 650 co-ops, has told Congressmen that the copper shortage is paralyzing extension of services endangering present transmission lines.

General Electric and Westinghouse, largest suppliers of transformers, say they are at 65% of capacity now, and are faced with further cuts in production in the near future, unless supplies increase.

Copperweld, one of the largest suppliers of wire to rural projects, reports that it will be out of copper in two months if present conditions continue.

The stalemate stems from the opposition of copper-state legislators to Representative James T. Patterson's bill calling for repeal of the 4c. import excise tax. Patterson, from the brass-mill district of Connecticut, has stated that he is not wedded to any definite plan other than a temporary moratorium on the duty. He has suggested that the tariff waiver apply only to the first 400,000 tons of imported metal each year.

The bill is slated for scrutiny by the House Ways and Means Committee, but may have to wait until the committee gets through with other tax troubles.

Representative John R. Murdock, of Arizona, chief opponent of the Patterson proposal, opposes any tariff reduction. In a speech on Feb. 4, the day Patterson's bill was introduced, Murdock said, "We can supply our own domestic copper requirements if the price permits."

## Pehrson Urges Billions for Stockpile Budget

The nation "is in a vulnerable position" with regard to strategic materials and should expect to spend from four to six billion dollars for stockpiling, according to Elmer W. Pehrson, chief of the economics and statistics branch of the Bureau of Mines. He said that mineral shortages would make it very difficult to mobilize American industry for another war, and that much of the Government-owned mineral supply has been depleted for postwar reconversion of industry.

Mr. Pehrson told a House mines and mining subcommittee that the first duty of the Army-Navy Munitions Board should be to acquire large quantities of scarce materials.

The committee was inquiring into the effect of the stockpiling program.

Present estimates, Mr. Pehrson said, are for a two-billion-dollar stockpiling program, but in his view a "more realistic approach" under present world marketing conditions would be a more expensive program.

"My thinking," he stated, "is in terms of a four-billion-dollar, a five-billion-dollar, or a six-billion-dollar program."

## McFarland Prods White House on Premium Cut

Contending that the Government's interpretation of the Premium Price Plan section of the Emergency Price Control Act of 1946 is erroneous, Senator McFarland, of Arizona, has stated that he will "take steps to preserve the rights of the mining industry."

The Western legislator has asked for copies of the Justice Department opinion which holds that the OWMR interpretation of the "not less favorable than heretofore" clause in the Act is correct (*E.&M.J.*, Feb. p. 68 and 69).

In a letter to John R. Steelman, Assistant to the President, Dec. 19, Senator McFarland asked for an explanation why the financial return to the producers of copper, lead, and zinc had not been as favorable as prior to June 30, 1946. "As sponsor of both the 1945 and 1946 Premium Price Plan legislation, I assure you that it was my intention, and I believe the intention of my associates in this legislation, that mining operations should receive such premiums as are necessary to keep them operating during the life of the plan, with the allowances specifically designated in the Act, plus the reasonable profit guaranteed to individual producers, as announced by the President in the minerals policy publicly promulgated April 24, 1943," the Senator's letter stated.

"Any interpretation that the word 'terms' does not include the above would in my opinion be an erroneous one," McFarland added.

## White House Undermines Buy American Provisions

With the same devious interpretation of law which has characterized both Administration and Supreme Court policies in recent years, Assistant to the President John Steelman has pulled the rug from under the "Buy American" provisions of the Stockpile Act, thus nullifying the plain objective of the law.

"Misunderstanding of the Buy American provision has led some producers of materials needed for the strategic stockpile to quote prices to the Government which are in excess of domestic market prices," Steelman said in a letter to Richard R. Deupree, chairman of the Army and Navy Munitions Board.

"If an item produced in this country normally sells in the domestic market in competition with foreign material at a quoted market price, there is no basis in the Act or in circular No. 37 of the Treasury Department [which provides for favoring purchase of domestic over foreign supplies if the domestic prices are not more than 25% greater] for the expectation that the Bureau of Federal Supply will purchase the item at a price in excess of the quoted market price. Purchases in such cases should not be over the market price, and in view of the magnitude of purchases by the Government, some concession from the market price might even be expected. In cases of this kind, the proper application of the differential would be to determine whether or not to accept a foreign bid in which the foreign bidder has offered to sell at less than the quoted market price."

Steelman qualified the 25% differential question by saying that "if domestic production of an item is normally small and little or none of it sold in competition with foreign production, there may not be any recognized domestic market price for the material as distinguished from a world market price. In such cases a domestic bid which is greater than the foreign bid should be accepted only if (a) it does not exceed the maximum allowable differential, (b) is justified by a prudent Governmental buying policy, and (c) is reasonable in the light of relevant price factors."

Steelman suggested to Deupree that a case-by-case analysis be followed in applying the "inconsistent with the public interest" clause in the Act. "For example, there may be a few cases where domestic sources should be conserved or supplemented, and for that reason a particular product should be obtained from foreign sources. It is plain that application of the statutory exception with respect to the public interest may in some cases result in the rejection of a domestic bid whether or not the cost would be unreasonable within the meaning of the Act."

# NEWS OF THE INDUSTRY

## Insurgent Brass Workers Secede From Union

Rebellion flared in the ranks of the International Union of Mine, Mill & Smelter Workers, CIO, late in January when the presidents of ten locals in District 6, chiefly composed of brass workers, issued a signed statement attacking the presidency of Reid Robinson as "a leadership that faithfully follows the Communist party line," and asking a complete investigation of the recent election and of Robinson's "whole history as a so-called trade union leader." Heads of seven locals, representing about 15,000 Connecticut brass workers, declared that a majority of members attending meetings had favored secession. This claim was challenged by Robinson, who thereupon suspended John J. Driscoll, secretary of the Connecticut CIO council, and John J. Mankowski. Both men announced they would ignore the suspension orders and proceeded to set up a Provisional Metalworkers Council, to which funds and contracts were transferred. The new council, still affiliated with CIO, and headed by Driscoll, claimed 14,000 adherents.

A meeting on Feb. 2 of Torrington, Conn., members to vote on secession broke up in disorder when the president of the local called on the police to eject Robinson from the hall. It was decided to hold a secret referendum on the question of withdrawal. On Feb. 7 members of Torrington Local 423 voted 707 to 304 against secession.

In other supervised elections secession was affirmed, 311 to 16, by employees of Bristol Brass Co., Waterbury, Conn., and 300 members of Local 462, Newark, N. J., all employees of Phoenix Brass Fittings Corporation, who voted unanimously to withdraw from the union. The Ansonia, Conn., local voted 930 to 299 to secede at a referendum held Feb. 27.

Efforts of the Provisional Metalworkers Council to conduct referendum votes at other plants in Bridgeport and Waterbury, Conn., met with a setback. Temporary injunctions were obtained by IMM&SWU officials restraining these locals from voting. However, the executive board of the Connecticut CIO council on Feb. 14 publicly upheld the legality of action taken up to that time by executives of the new council.

District 6 of the union numbers 28,000 members, of whom 21,000 are brass workers belonging to 16 locals in Connecticut. At latest report the Provisional Metalworkers Council claimed that an estimated 15,000 members of 14 locals had seceded. Total membership of the IMM&SW union is placed at around 100,000.

The possibility of intervention by Philip Murray, CIO president, was indicated with the summoning of Robinson to a conference at CIO headquarters in Washington on Feb. 18. Murray is said to be anxious to purge his organization of left-wing influences, and reportedly blocked Robinson's re-election as a CIO vice president at the union's recent convention.

Robinson's re-election as president of IMM&SWU was bitterly fought by anti-communist elements in the union, whose candidate, James J. Leary, was defeated 37,736 to 31,508. Minority members of the union canvassing committee charged that improper voting practices had made Robinson's election possible. In his syndicated column, titled "Inside Labor," on Feb. 12, Victor Riesel commented at length on allegations of wholesale voting irregularities and ballot-box stuffing which are said to be documented in a report prepared by this three-man group for top CIO officials.

It was reported March 1 that 5,500 members of 25 locals in District 3, in the Midwest, had seceded.

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## Anaconda to Prospect in British Guiana

Exclusive prospecting rights in parts of British Guiana have been applied for by Anaconda Copper Mining Co., according to A. G. King, a lawyer and member of the colonial legislature, who stated, on returning from New York, that the company was prepared to spend "any sum within reason." King added that he had settled various agreements with Anaconda for options on privately controlled Crown lands and over that part of the interior for which the company is asking exclusive permission to prospect.

Anaconda officials have said that they expected to send engineers to British Guiana in the near future. Gold as well as bauxite and other minerals are found in the colony, and some uranium ore has been produced.

## New Foundation Fosters Pan-American Relations

Three one-thousand dollar fellowships for qualified Latin American students have been established at Carnegie Institute of Technology by the Matthes Foundation, Inc., 12 East 41st St., New York 17, N. Y. The fellowships provide for graduate study in civil, electrical, mechanical, chemical, and metallurgical engineering, as well as physics, chemistry, and mathematics. Recipients will be chosen on the basis of competitive examinations to be held on or before March 31, under the auspices of the Graduate Record Office of the Carnegie Foundation.

The Matthes Foundation was established in 1946 by Albert J. Matthes, president of Machinery Liquidating Co., whose extensive international business dealings led him to take a special interest in offering advanced educational opportunities to Latin American engineering students.

## Noranda and Bridgeport Brass to Operate Plant

Noranda Mines, Ltd., has acquired from War Assets Corporation plant facilities at Montreal East, Canada, which the company will equip and operate for copper and brass fabrication in association with Bridgeport Brass Co. Noranda will control the new company, to be known as Noranda Copper & Brass, Ltd., now being formed, in which the Bridgeport company holds a substantial minority interest, according to an announcement by James Y. Murdoch, president of Noranda Mines, who will serve as board chairman of the new concern.

Operations on a limited scale have begun at the plant, formerly used by Canada Strip Mills in producing brass strip for munitions, which was taken over on Jan. 1. Modern equipment is being installed as rapidly as possible to adapt the plant to the production of a complete line of copper and brass mill products.

Herman W. Steinkraus, president of Bridgeport Brass Co., will head the new company. Operation of the plant will be under the supervision of M. W. Batchelor, vice president in charge of operations for Bridgeport.

# S.E.C., Gold, Silver, and Metal Subsidies Discussed at Colorado Mining Meeting

Controversial issues pertaining to mine finance, money, subsidies, metal economics and mineral self-sufficiency were aired at numerous sessions of the 50th anniversary celebration of the Colorado Mining Association recently held in Denver. More than 1,200 members and guests attended. Robert S. Palmer, association manager, welcomed the members and urged free discussion of all issues on a non-political basis.

James Boyd, president of the Colorado School of Mines, presided at a session on mechanical requirements in the mining industry, in which M. I. Signer, associate professor of mining, analyzed the costs of underground mining, and outlined areas where greatest economies could be effected, citing such new developments as the scraper-slot mining method, fusion piercing and tungsten-carbide bits. Prof. C. W. Livingston described the "clover-leaf burn cut" which permitted Michigan operators to boost development advances from 8 to 24 ft. per 24 hrs. See pages 73 to 77.

E. V. Gent, secretary of the American Zinc Institute, estimated that if present conditions prevail without setback, the 1947 consumption of slab zinc will be about 920,000 tons, of which about 100,000 tons will probably be imported. It is anticipated that the galvanizing industry will consume about 375,000 tons and the die-casting industry about 240,000 tons in 1947 on the basis of current demands.

F. E. Wormser, of the Lead Industries Association, urged increased production to help meet current needs totalling roughly 1,000,000 tons annually. He estimated that the cable industry alone would require about 200,000 tons annually for the next few years, and that the battery industry would require 300,000 tons per year, of which 75,000 tons would be new lead.

Emphasizing the strategic importance of manganese, M. B. Huntingdon, of the United Mining & Milling Corporation, related the difficulty of American producers in competing with manganese ores from India, where wage rates are 10c. per day.

Molybdenum sales have dropped, according to C. J. Abrams, general superintendent of Climax Molybdenum Co., but present experimental and test work indicates a strong future market.

G. T. Harley, manager of International Minerals & Chemical Corporation, at Carlsbad, N. M., said that the companies in the Carlsbad area had reserves of good ore which would enable them to supply this country with 500,000 tons of $K_2O$ per year for 158 years, and that if lower-grade bodies were exploited, the entire area could supply this country with potash for 500 to 700 years more.

Although the present demand for tungsten is low, compared with war consumption, George Teal observed that the outlook for future demand is bright. Much of the surplus has been used up or is in permanent stockpiles. South American imports have been reassigned to Europe, where the demand is heavy, and Chinese production is going to Russia instead of this country, he said.

The history of the tungsten-carbide bit was sketched by William Loach, who said that many experiments point toward the success of these bits, and that the chisel-type with light machines would probably be used most frequently.

J. L. Robison, of the U. S. Vanadium Corporation, Grand Junction, also summarized results of experiments with several types of tungsten-carbide bits made at Rifle, Colo. Tests with sintered and cast (Haynes Stellite) types of inserts brazed into grooves cut into Jackbits showed that all insert bits cannot be applied to the same type of rock. He exhibited one chisel bit which had drilled more than 150 ft. without showing appreciable wear. Bits hard-faced with Hastellite were also successful in the sandstone of the Rifle mine. See also pages 57 to 60.

## Operators Criticize S.E.C.

At a dinner attended by E. M. Hanrahan, Securities and Exchange Commissioner, and E. T. McCormack, of the Corporation Finance Division of SEC., numerous mining operators and promoters divulged their dissatisfaction with rules of the SEC act, and with treatment received from SEC officials. Mr. Hanrahan promised to weigh the testimony, but reaffirmed the intention of the Commission to protect the public. He also stated that as a result of conferences with mining men, the Commission has under consideration Section 221-H of Regulation A of the Act, and that an announcement would be forthcoming within 30 days.

To retain our mineral self-sufficiency, O. W. Bilharz, of the Tri-State Ore Producers Association, asserted a need for continuous extraction of ores being exploited. The law of supply and demand, and high prices are not entirely sufficient to guarantee this type of conservational exploitation, he contended.

H. S. Worcester, who presided at the session covering subsidies, read telegrams urging retention of premium or subsidy payments after July 1947 from the Cuba Mining Co., in Wisconsin; Mr. Lovell of the Calumet & Hecla Consolidated Copper Co., in Michigan; the Sunset Minerals Co., Idaho; the Peru Mining Co., N. M.; and the Consolidated Coppermines Corporation, New York. Elmer Isern, of Eagle Picher Mining & Smelting Co., emphasized the need to conserve metal and mineral resources for security and industrial purposes. He pointed out that 800 mines are still dependent on premium payments, and that at least one-third of the current production of copper, lead and zinc would be lost if mines failed to receive the assistance they receive today.

E. H. Snyder, general manager of Combined Metals Reduction Co., Utah, analyzed the objectionable features of the Premium Price Plan, and explained his substitute plan which would pay a direct bonus to all metal producers on a sliding scale taking into consideration the quantity of production of operators as a measure of their production costs. To illustrate, he suggested that producers might receive 8c. per pound of metal for the first 500 tons produced, 6c. per pound for the next 500 tons, 4c. per pound for the next 1,000 tons, etc., up to 5,000 tons, where the bonus would stop. He calculated that the weighted average for a large group of mines would amount to only 1.2c. per pound of metal. The plan was designed to equalize the highest cost one-third with the lowest cost one-third of our domestic mining industry.

C. O. Hardy, Chicago Association of Commerce, defined the gold standard as a simple system of relating the values of currencies to each other. Fear of deflation, bursts of nationalism, and government interference with the economic life of a nation are factors which weaken gold's position. The extreme reluctance of the world to make changes in its basic institutions is working in favor of gold, he observed.

Prof. L. H. Haney, New York University, maintained that gold could solve the problem of inflation if returned to circulation, and characterized the conduct of the New Deal as "tyrannical" when it seized gold and repudiated gold bonds.

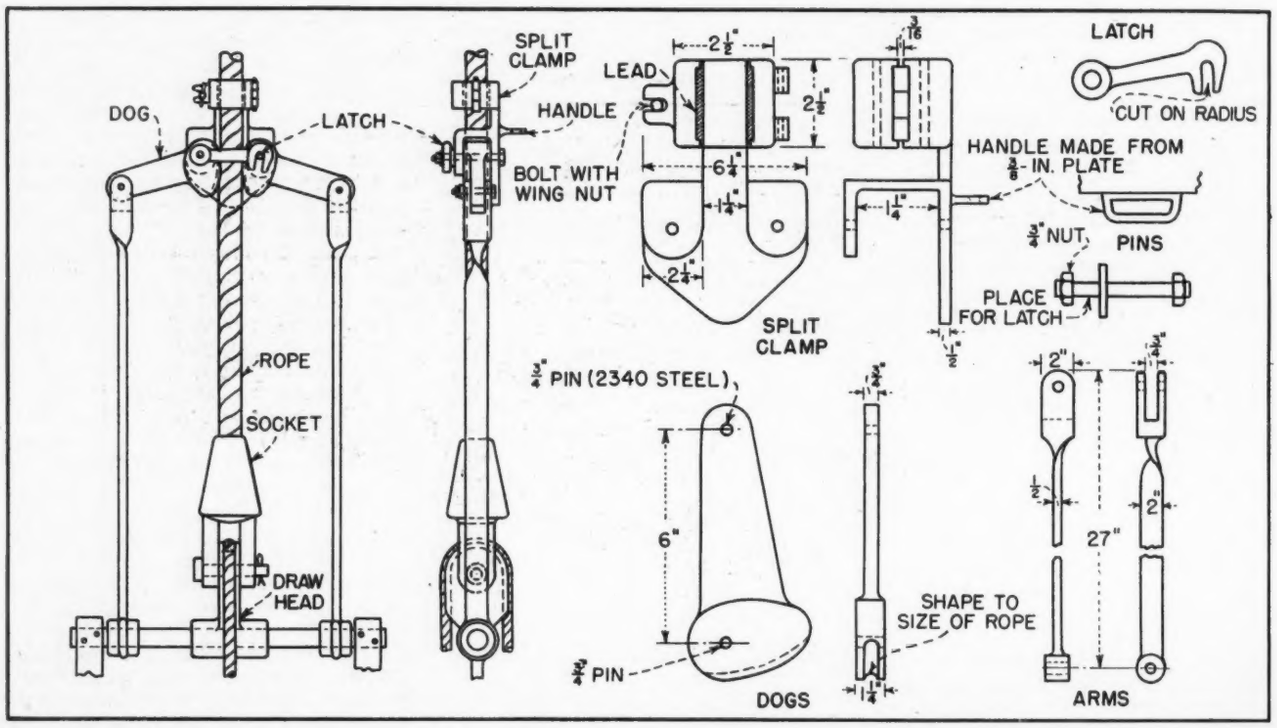
J. A. White characterized the latest move of Great Britain to dethrone silver as a trend toward a paper (promise-to-pay) standard and warned that a recurrence of the silver dumping in 1920 could precipitate the closing of many mines in the Rocky Mountain states.

J. W. Snyder, Secretary of the Treasury, extended President Truman's greetings to the convention. He reviewed the importance of gold and silver in our monetary system. Treasury holdings in gold have increased from 6,000 tons in 1931 to nearly 20,000 tons at present, and silver holdings increased from 560 tons in 1931 to 58,000 tons at present, he reported.

New officers for 1947 are B. T. Poxson, president; C. J. Abrams, first vice-president; M. E. Shoup, second vice president; John Hamm, third vice president; Harrison Cobb, fourth vice president; C. O. Withrow, treasurer; and R. S. Palmer, executive manager.

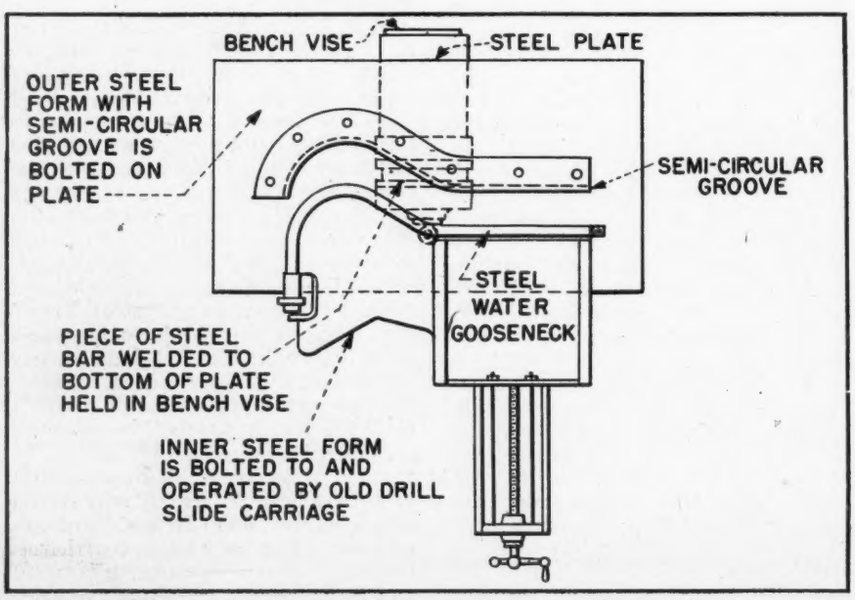
# OPERATING IDEAS

## Shaft Safety Device for Man Truck




**This safety device was designed by Phil Keast, master mechanic, Empire Star Mines Co., Ltd., Grass Valley, Calif., to protect man trucks operating in the inclined shaft in event of rope failure near the socket, pin breakage, or failure of the draw head. The split clamp contains lead filling to prevent injury to the rope. When man trucks are used, the device may be attached in a few seconds by means of a latch and clamp. Tests in which the rope was severed at the socket proved the dependability of the device.**

## Jig Shapes Steel Goosenecks for Drills


BENCH VISE
STEEL PLATE
OUTER STEEL FORM WITH SEMI-CIRCULAR GROOVE IS BOLTED ON PLATE
SEMI-CIRCULAR GROOVE
STEEL WATER GOOSENECK
PIECE OF STEEL BAR WELDED TO BOTTOM OF PLATE HELD IN BENCH VISE
INNER STEEL FORM IS BOLTED TO AND OPERATED BY OLD DRILL SLIDE CARRIAGE

At the Anaconda Copper Mining Co., Butte, Montana, steel gooseneck water connections are made for drifter drills out of scrap hollow drill steel with this jig. After the drill steel has been turned to proper shape in a lathe, it is heated to a dull cherry color and inserted between the jaws of the jig. Rotation of the slide handle advances the inner form toward the fixed outer form, thereby shaping the gooseneck as shown. The jig is mounted on a steel plate. A short length of steel bar is welded to the bottom of the plate to permit attachment to a bench vise.

The steel goosenecks are used on drills instead of conventional units made of short lengths of rubber hose. The jig was made of scrap materials, including a drifter slide.

# SAFE POWER

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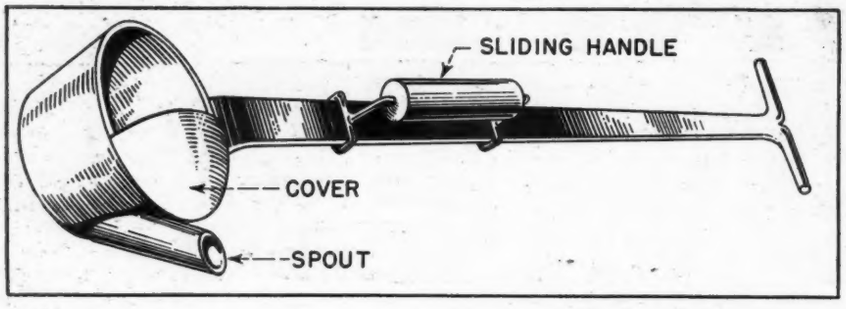
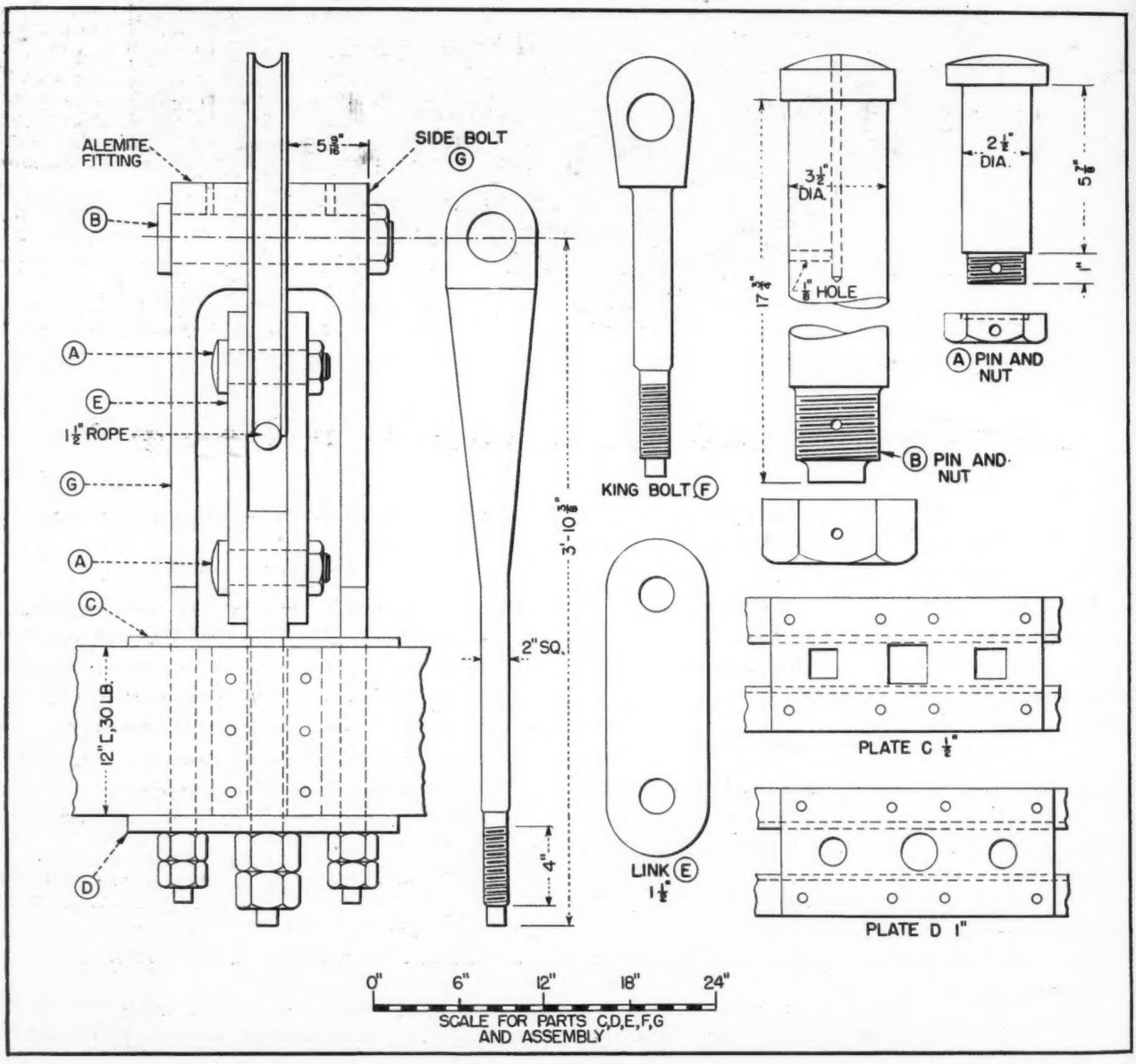
# Sliding Handle Improves Babbitt Ladle

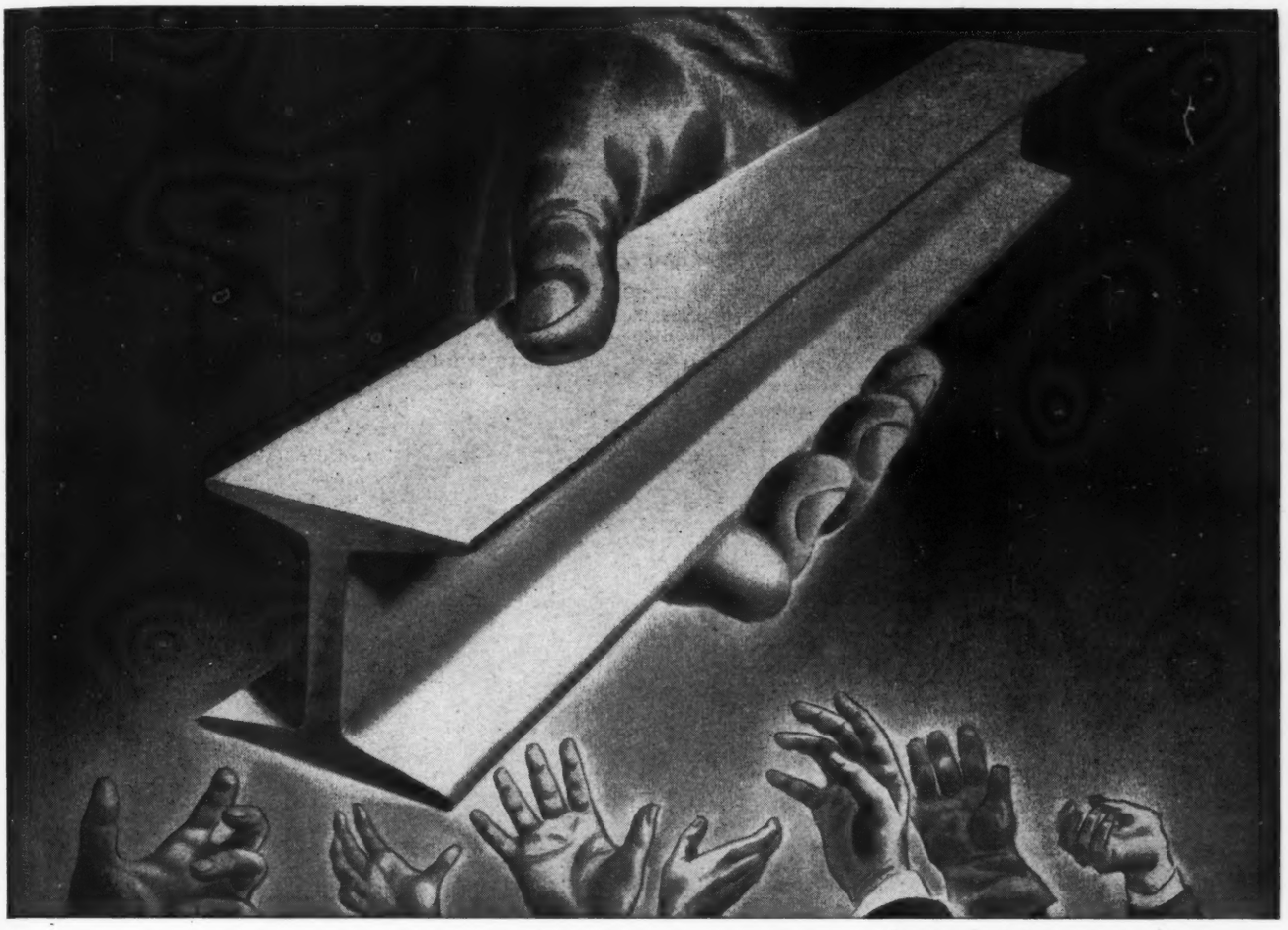



The sliding handle of this improved babbitt ladle is pushed back during the melting period, thereby remaining cool. As the handle is well above the hot metal surface, the workman is protected from splashing while transporting the ladle and pouring. As heavier metals settle out in the molten state, the bottom-feed feature of the spout assures a more equal mixture.

# Triple King-Bolt Safeguards Skips and Cages




To prevent skips and cages from falling because of accidental failure of a king-bolt, this triple king-bolt assembly was designed by the mechanical department of McIntyre Porcupine Mines, Ltd., Schumacher, Ontario. The main weight of a 13-ton loaded skip is normally carried by the short links, E. Auxiliary side links, G, are slack—about one-eighth inch of slack is generally allowed. If bolt A should fail, bolt B would carry the weight through side links G. A similar safety installation is used on cages.



# Brother, can you spare a beam?

Steel is like money. When you need it, you need it *badly*. That's why we have many steel plants to give next-door service most anywhere.

But lately it's getting so we hesitate to open the mail or answer the phone. We *know* there will be friends asking for steel—steel they need badly—and often we just are not able to fill the bill.

**And here's what's causing it all**

For a while it looked as though production would soon catch up with demand. Now that time seems more distant. The many things holding up top steel production have been slow to clear away. Unpredictable stoppages keep popping up, and shortages have brought other delays. You know about many of them. We've been doing our best, but for reasons beyond our control, we're still getting orders we can't fill.

**But remember this:**

One of these years the steel situation is going to change for the better. When that happens our plants will be among the first to stock products now hard to get and we'll burn up the roads rushing your steel to you. In preparation for that day, we're improving and expanding facilities, to protect the quality of Ryerson steel and ship it to you faster.

We are even now building a new plant and adding extensively to equipment at 11 others.

Meanwhile, the steel you need or a practical alternate may be in stock. So contact the nearest Ryerson plant with the full knowledge that we will do everything in our power to work with you.

JOSEPH T. RYERSON & SON, Inc., Steel-Service Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

# RYERSON STEEL

# PERSONAL NEWS

**R. W. Lottridge,** formerly chief of the mechanical department of the Federal Mining & Smelting Co., in Idaho, has been promoted to be general superintendent. **William J. Coombe, Jr.,** superintendent of the Page mine since 1938, is advanced to general mine superintendent, and **Troy M. Tower** succeeds Coombe as superintendent at Page.

**H. W. Gould,** mining engineer and senior partner in the firm of H. W. Gould & Co., has returned to his headquarters in the Mills Bldg., San Francisco, Calif., from a professional trip to northern Mexico.

**James L. Bruce,** general manager for Cyprus Mines Corporation, with offices in the Pacific Mutual Bldg., Los Angeles, Calif., has gone to Cyprus on professional business.

**Peter S. Geshell,** formerly metallurgist for the United Verde Branch of Phelps Dodge Corporation at Jerome, Ariz., has changed his address from Clarkdale to Morenci, Ariz.

**Juston J. Mechlin,** traffic manager for Calumet & Hecla Consolidated Copper Co. since 1917, retired from active service on Jan. 1, but will continue with the company in a consulting capacity. He is succeeded as traffic manager by his son, **R. Douglas Mechlin.**

British Columbia members of the Canadian Institute of Mining and Metallurgy attending the annual meeting in Ottawa in January included **Dr. J. F. Walker; Dr. M. S. Hedley; J. A. Pike; T. M. Waterland; Frank A. Fortier; Percy E. Bloomer;** and **Bruce Hurdle.**

**J. J. Hogan,** recently on the staff of Consolidated Mining & Smelting Co. of Canada, Ltd., at Kimberley, B. C., and Yellowknife, N. W. T., has arrived in British Guiana to take charge of the operations of Pott Falls Gold Mines, Ltd.

The retirement of **Dr. Oliver Bowles,** Chief of the Nonmetal Economics Division of the U. S. Bureau of Mines, after 33 years of Government service, was announced Feb. 6 by **Dr. R. R. Sayers,** Director of the Bureau. Dr. Bowles has achieved international prominence for his pioneer achievements in the field of non-metallic minerals and is the author of more than 250 publications dealing with this subject. He was recently elected a director of the American Institute of Mining and Metallurgical Engineers.

**J. H. Hitchens** has left for British Guiana to become mine foreman for Cuyuni Goldfields, Ltd. He formerly held a similar position with Hedley Mascot Gold Mines, Ltd.

**A. C. Harding,** mining engineer, formerly general superintendent for the Baroid Sales Division of the National Lead Co. at Los Angeles, has resigned after nine years' service with that

**A. C. HARDING**

company and is now at Moorcroft, Wyo., where he is organizing a new company to build and operate a bentonite plant to supply bentonite for oil-well and foundry use. The new plant is expected to be in operation in June.

**W. C. Douglass,** general manager, and **George L. Mill,** consulting metallurgist, of Kelowna Exploration Co., Ltd., have returned to New York after inspecting progress of the associated South American Development Co. operations in Ecuador.

**A. S. Baillie,** vice president and general manager of Granby Consolidated Mining, Smelting & Power Co., Ltd., has been elected president for 1947 of the Mining Association of British Columbia. **Dr. Howard T. James,** whom he succeeds, is vice president.

**L. Baldee,** general shops foreman for Utah Copper Division of Kennecott Copper Corporation, has been promoted to master mechanic at the Arthur plant, succeeding **H. B. Duckworth,** who retired Jan. 1.

**August Grunert,** mining engineer, of Butte, Mont., has sold his interest as manager and principal owner of Western Iron Works, and will resume consulting practice with offices at 1128 Farrell St., Butte. Mr. Grunert was formerly supervising engineer for the Montana-Idaho Mining Loan Division of the RFC, and is a former secretary of the Mining Association of Montana.

**Klem B. Gross,** who, during the war was with Mount Isa Mines, Ltd., has returned to his former position of general manager of New Guinea Goldfields, Ltd.

**Graham Hall,** who has been senior geologist at Mount Isa Mines, Ltd., Queensland, is now chief geologist for Electrolytic Zinc Co. of Australasia, Ltd., at the company's Rosebery mines in Tasmania.

**D. Burger,** mining engineer, recently discharged from the Netherlands Navy after 4½ years of service, during the latter part of which he was assigned to the N.E.I. Department of Mines, Batavia, has joined the staff of Mt. Isa Mines, Ltd.

**Daniel B. Gregg** recently left the staff of the Tungsten Mining Corporation at Henderson, N. C., where he had been assistant superintendent, as well as for Haile Mines, Inc., for the last three years. He may be addressed at 908 Chestnut St., Henderson, N. C.

**John G. Reilly** has been appointed managing director of Cia. de Real del Monte y Pachuca, Pachuca, Hidalgo, Mexico.

**Erle P. Dudley,** mining engineer long associated with Bunker Hill & Sullivan Mining & Concentrating Co. at Kellogg, Idaho, has presented to the College of Mines of the University of Washington, at Seattle, Wash., through Dean Milnor F. Roberts, a collection of maps which Mr. Dudley has assembled over a period of a quarter of a century.

**L. A. Van Fleet,** of the U. S. Bureau of Mines, has been transferred from Mt. Hope, W. Va., to Phoenix, Ariz., where he will serve as safety instructor.

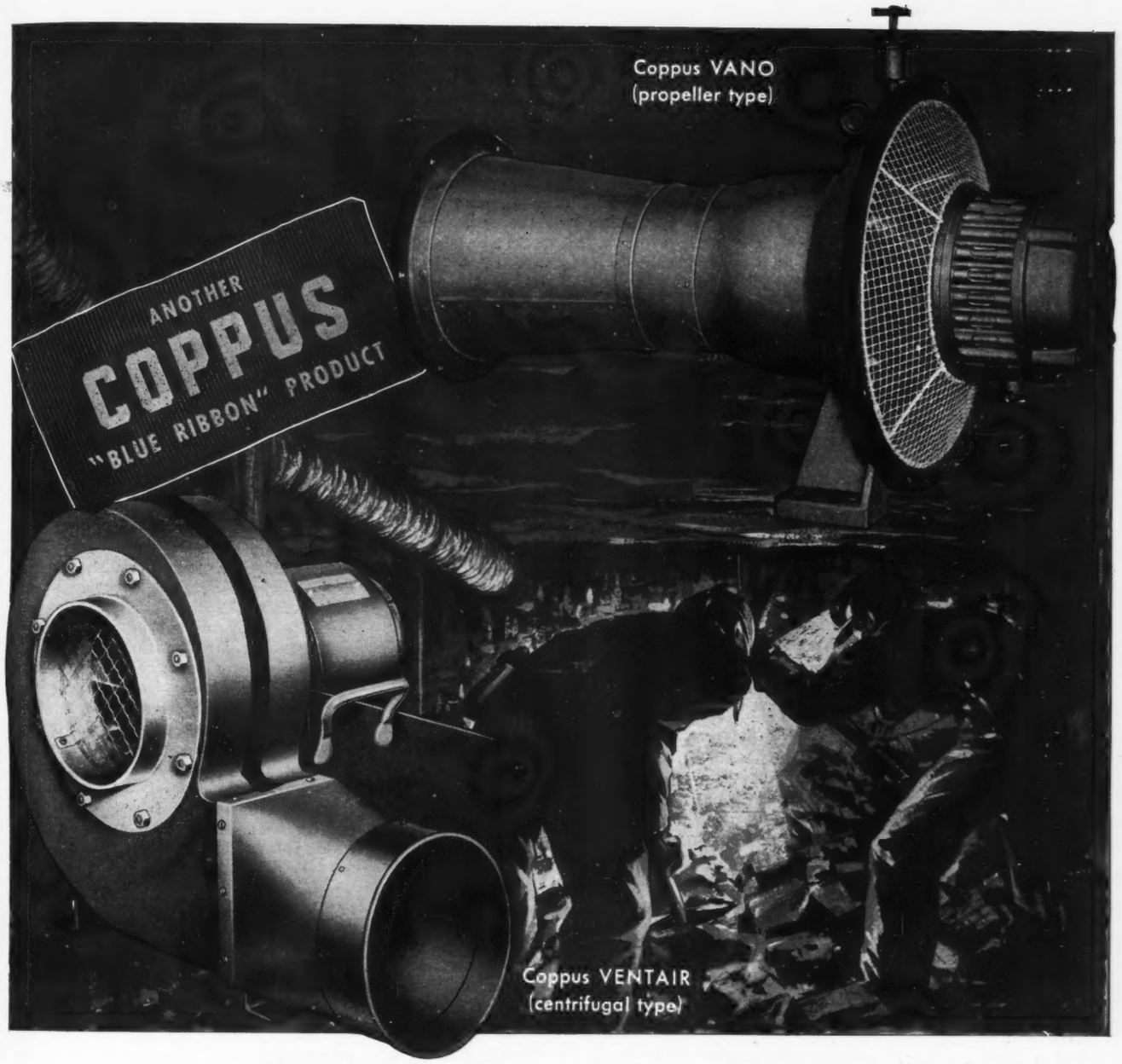
**Glenn C. Waterman** has resigned as chief engineer and geologist for Idaho Maryland Mines Corporation to join the foreign operation department of Anaconda Copper Mining Co.

**Patrick D. McMaster** has been transferred from the U. S. Bureau of Mines Raleigh Division to the War Department for service in Japan. His address is APO 500, care of Postmaster, San Francisco, Calif.

Retirement of **Hubert Merryweather,** general manager of ore properties, Bethlehem Steel Co., was announced on Jan. 31. Mr. Merryweather joined the company in 1910 as mine superintendent of Juragua Iron Mines, in Cuba, and subsequently managed Bethlehem's Tofo iron mines, in Chile.

**F. R. Hockey** was recently elected president of the Australasian Institute of Mining and Metallurgy for 1947. Mr. Hockey is general superintendent of mines and quarries for Broken Hill Pty. Co., Ltd.

The appointment of **Olaf P. Jenkins** as chief of the Division of Mines, effective Feb. 1, has been announced

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Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

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*Representatives listed in METAL and NON-METALLIC MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER...Coppus Engineering Corporation, Worcester 2, Massachusetts.*

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by **General Warren T. Hannum**, Director of the Department of Natural Resources of the State of California. Mr. Jenkins has been with the Division of Mines since 1929 as chief geologist, and was formerly associated with State resources departments in Washington, Arizona, and Tennessee.

Appointment of **O. B. J. Fraser** as assistant manager of the Development and Research Division of International Nickel Co. has been announced. He succeeds **H. J. French**, who recently was made assistant vice president of the company. Mr. Fraser has been director of technical service on International Nickel's mill products for the past 13 years, and since March 1945 has also headed the Industrial Chemicals Section of the Development and Research Division in New York. He is vice chairman of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. **Dr. William A. Mudge** succeeds Mr. Fraser as Director of the Development and Research Division. **William F. Burchfield** was named assistant director.

## OBITUARIES

**Dr. Otto Sussman**, chairman of the board of American Metal Co., died in New York on Feb. 3, at the age of 68. He played a part in the development of copper mines in Rhodesia, zinc in New Mexico, and molybdenum in Colorado, and was a director in many mining companies. He was a native of Bavaria and was educated there in the Royal Academy of Mines, the University of Wuerzburg (Ph. D.), and at the universities of Leipzig and Munich. Dr. Sussman joined the American Metal Co. in 1904, became a director in 1914, president in 1929, and chairman of the board in 1934. He was a past president of the Mining and Metallurgical Society of America and a member of many associations and clubs.

**A. W. Frolli**, former assistant manager of the southwestern division of the American Smelting & Refining Co., with offices in Tucson, Ariz., passed away recently in El Paso, Tex. At one time he had been general manager for the Anglo American Mining Corporation at Randsburg, Calif.

**Charles Richard Knutson**, 78, retired mine superintendent of Phelps Dodge, died recently in Douglas, Ariz. Knutson came to America from Sweden when he was 18 years old and was connected with mining activities both in Arizona and Mexico until his retirement.

**H. J. Fennimore**, accountant, tax counselor and a prominent figure in Montana mining circles, died at his home on Jan. 7 after a lengthy illness. Mr. Fennimore was vice president and treasurer of Jardine Mining Co. and president of Rademont Mining Co.

**Richard Bernhard**, chief engineer of the Traylor Engineering & Manufacturing Co., of Allentown, Pa., died on Feb. 2, at the age of 73, after several months' illness. Mr. Bernhard's crusher designs and intimate knowledge of mining machinery established him as one of the world's outstanding engineers in this field. He became chief engineer of the Traylor company in June 1917, after serving in a similar capacity with the Power Mining & Machinery Co., of Milwaukee, Wis.

**Willard E. Hales**, 67, mining engineer, died at his home in Los Angeles, Calif., on Feb. 3. A graduate of the University of Idaho, he served as superintendent of Treadwell Yukon Mining Co. at Tybo, Nev., from 1926 to 1930. In 1930 he entered consulting practice in Los Angeles and during World War II was associated with Basic Magnesium Corporation at Henderson, Nev.

**E. F. Brown**, a pioneer mining man of Iron Mountain, Mich., died on Jan. 20 at the age of 85. As a young man he was financed by Andrew Carnegie in opening up the Pewabic and Walpole iron mines. Later he turned to banking and was president of the Iron Mountain First National Bank for 40 years. He was also manager and part owner of the Mineral Mining Co., which developed the James, Wauseka, Breen, and Nanaimo mines in the Iron River district of the Menominee Range.

**H. Hobart Porter**, chairman of the board of American Water Works & Electric Co., and a mining engineer of note, died on Feb. 9 in New York City, aged 81. A graduate of the Columbia School of Mines, Mr. Porter followed mining work in Mexico and the Southwest for some years before organizing the engineering firm of Sanderson & Porter in 1894. He was elected president of the American Water Works Co. in 1914.

**Charles Henry Baldwin, Jr.**, 50, assistant master mechanic at the Garfield, Utah, plant of American Smelting & Refining Co., died on Feb. 1 in a Salt Lake City hospital.

**John Walter Anderson**, 52, general foreman of the Bingham, Utah, district for the U. S. Smelting, Refining & Mining Co., and a former mayor of Eureka, Utah, died Jan. 7.

**Joseph M. Beckstrom**, 67, welding department foreman of the Utah Copper Division of Kennecott Copper Corporation, Garfield, Utah, died on Feb. 2. A native of Sweden, he had been employed by the company 25 years.

**Sidney B. Wood**, mining engineer, sportsman, and adventurer, who was a colorful character in the development of Arizona mining around the turn of the century, died on Jan. 27 in New York at the age of 68. Mr. Wood had been interested in silver mining in New Mexico and gold mining in California, where he formerly made his home at Grass Valley.

**Peter A. ("Pete") Keegel**, a mining and metallurgical engineer actively associated with the growth and development of the mining industry of southern Nevada, died on Feb. 9 at Las Vegas, Nev., in his 69th year. He leaves a son, **C. P. Keegel**, also a mining engineer.

**Rowland W. Barr**, manager of the dredge division of the Bucyrus-Erie Co., South Milwaukee, Wis., was killed on Feb. 3, 1947, in Raleigh, N. C., when he fell under the wheels of a moving train, which he was attempting to board. He had left the train to send a telegram to New York informing friends of his late arrival. Mr. Barr graduated from the University of California in 1924, worked with Bucyrus-Erie as electrical engineer from 1926 to 1928, then went to Chile, where he served as electrical engineer for Braden Copper Co. In 1938 he became electrical engineer for Pato Consolidated Gold Dredging, Ltd., in Colombia, eventually serving as manager of the property. He returned to the Bucyrus-Erie Co. in 1945. A member of both the A.I.M.E. and the A.I.E.E, Mr. Barr had many friends in both professions. Surviving are his wife, Arlene, a son, John, and a daughter, Betita.

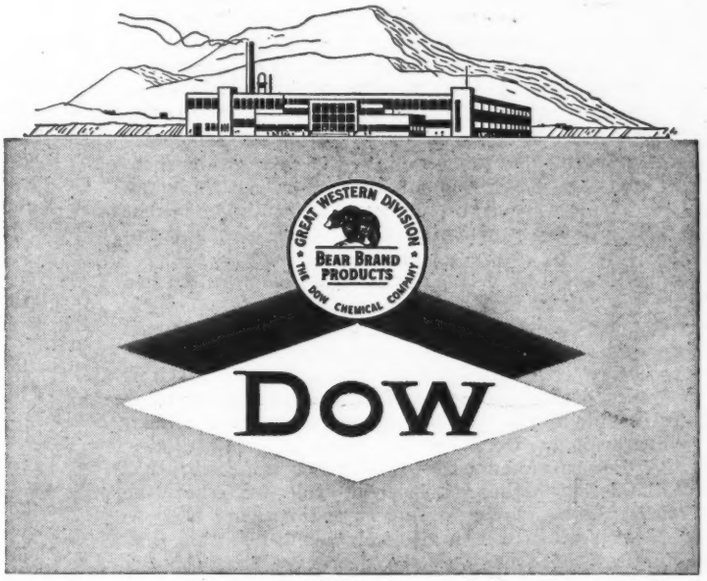
## F. W. Maclennan

### An Appreciation by Sam A. Lewisohn

Francis William Maclennan, vice president and consulting engineer of Miami Copper Co., and one of the country's best known and highly esteemed mining engineers, died in Los Angeles, Calif., on Jan. 28, 1947.

Starting with Miami Copper in 1913 as mine superintendent, he subsequently became assistant manager and, in 1919, general manager, in which capacity he was in charge of all operations for 19 years. In 1937 he was made vice president and consulting engineer and from that time on, while residing in Los Angeles, kept in close touch with operations through frequent visits to Arizona. From 1941 until his death he was also vice president and consulting engineer of Miami's subsidiary, Castle Dome Copper Co., Inc. His experience and knowledge were of the greatest value in the successful development of the Castle Dome property.

Born in Cornwall, Ont., on Oct. 14, 1876, he was graduated from McGill University in 1898 with the degree of E. E. He spent the year 1898-99 at the University of Liege, Belgium, and in 1900 he received the degree of

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Great Western Division

**THE DOW CHEMICAL COMPANY**

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*PIONEER PRODUCERS OF XANTHATES FOR METALLURGICAL USE*

E. M. from McGill University. From 1901 to 1912 he was respectively a member of the engineering staff of Le Roi mine, in British Columbia; manager at Velvet mine, Sheep Creek, B. C.; chief engineer at Cornucopia Mines, in Oregon; smelterman at Utah Consolidated smelter, Murray, Utah; superintendent, Oro Denoro mine, Summit, B. C.; engineer, Highland Boy mine, Bingham, Utah; superintendent, Ely Witch mine, Ely, Nev.; and for three years general superintendent of mines, Cerro de Pasco Copper Corporation in Peru.

Joining Miami Copper Co. Mr. Maclennan immediately foresaw the necessity of achieving almost unbelievably low mining costs in order to work the large deposits of lower-grade ore on the Miami property economically. When the time came to change over from the so-called high-grade orebody, he was ready with an ingenious method of block-caving which he had gradually developed. In 1930 he presented an epochal paper, "Miami Copper Company Method of Mining Low-Grade Orebody," at the New York meeting of the American Institute of Mining and Metallurgical Engineers. In 1931 the Institute awarded him the William Lawrence Saunders Medal for distinguished achievement in the mining of low-grade copper ores. This medal had previously been awarded to but four eminent mining engineers—David W. Brunton, Herbert Hoover, John Hays Hammond, and Daniel C. Jackling. In the same year McGill University conferred upon him the honorary degree of LL. D.

He was a member of the American Institute of Mining and Metallurgical Engineers, the Mining and Metallurgical Society of America, the American Mining Congress and the Canadian Institute of Mining and Metallurgy. Also the California Club, Los Angeles; Wilshire Country Club; Los Angeles Country Club; Phoenix Country Club, Phoenix, Ariz.; Almaden Club, and Cobre Valle Country Club, Miami, Ariz.

Mr. Maclennan was not only a brilliant engineer but also a conspicuously skillful, resourceful, and courageous mine and mill operator. Many of the metallurgical improvements at Miami during his administration of the property were due to his own personal ingenuity and planning. He had an uncanny ability to put his finger on unnecessary expense and to reduce costs.

His sparkling personality never failed to attract people, and his friends are legion. He was a staunch and loyal friend. His associates and fellow employees will long remember his friendly human qualities of unfailing courtesy and consideration, cheerfulness, and lively humor.

He is survived by his widow, Mrs. Alta May Maclennan, and two sisters, Mrs. Grace Maclennan Scarth and Miss Ella Maclennan, of Cornwall, Ont.

# LETTERS

## Small-Mine Owners Merit Representation

*The Editor:*

I was interested in reading in the January issue of the *Engineering and Mining Journal*, that the American Mining Congress has appointed a committee to act in an advisory capacity to the Secretary of the Interior in regard to mining. However, in going over the names of the individuals that constitute the membership of this committee, I am a little disturbed.

The reason for my being disturbed is not because I do not think the men who are going to be members of this committee are not capable, as I am sure they are most capable, but it is the fact that I do not see among them one representative of a small mining company or group of small mining companies. There is no doubt that these men will well represent the large mining companies, and will see to it in all recommendations that they make to the Secretary that the big mining companies' interests are well taken care of. Regardless of how fair the members of this committee may want to be toward small mining interests in connection with any recommendations they may make, they are human and are going to make recommendations which will best suit the big mining interests of this country.

For instance, in the same issue of the *Engineering and Mining Journal* which carried the names of the committee appointed by the American Mining Congress, I read another article having to do with an address made by Howard I. Young, chairman of the committee, before the Tri-State Zinc and Lead Ore Producers' Association, on Dec. 3 last, in which he stated that he was irrevocably opposed to a continuation of the Premium Price Plan or any similar system of profit control. Mr. Young's company, being a large, integrated one, is probably in a position to survive without a subsidy; thus he is not particularly interested in any Premium Price Plan. In the first place, a Premium Price Plan has been of great help to the small mining operator whose property probably contains low-grade ore, and is also a high-cost one. He therefore cannot exist unless he makes a profit on his mining operations.

This letter is not written to set up an argument in favor of the Premium Price Plan, although I do feel that there should be continuation of some form of a Premium Price Plan which would be helpful to high-cost mine operators after next June 30. Because of our acknowledged national shortage of base metals, the production from operations which require premium consideration should not be lost. The civilian requirements, and in addition thereto, the building up of a stockpile against any future national emergency, would seem a strong enough argument for continuation of a Premium Price Plan. The main point is that Mr. Young, in making his statement, was expressing the view of the large mining interests.

In connection with the labor-management conference which was held in Washington some months ago, the National Small Business Men's Association drew to the attention of the members, of which I am one, the fact that small business had not been invited to be present at that conference. It was brought to our attention that the conference members were drawn from large industry and they would represent only, in total, a small percentage of labor in this country.

National small businesses employ a great many more people than do the large industries. I am not in any position to say whether the same relationship exists in regard to the small mines as against the large mines, but I do know, and I am sure you will agree with me, that the small mines in this country contributed, in total, a great deal toward the recent war effort. Likewise, I am equally as convinced that if given a fair opportunity they can contribute much help toward developing new mineral resources and required civilian production now and in the future.

The small mining interests are entitled to a voice in whatever is done by the Department of the Interior.

Therefore, I suggest that a representative group of small mining interests across this country should form an advisory committee to Secretary Krug to make recommendations for the benefit of small mining companies, as well as of the mining industry as a whole.

EWART L. PETLEY

*Vice-president and general manager Fredericktown Lead Co., Fredericktown, Mo., Jan. 31, 1947.*

## Comments on Valuation

*The Editor:*

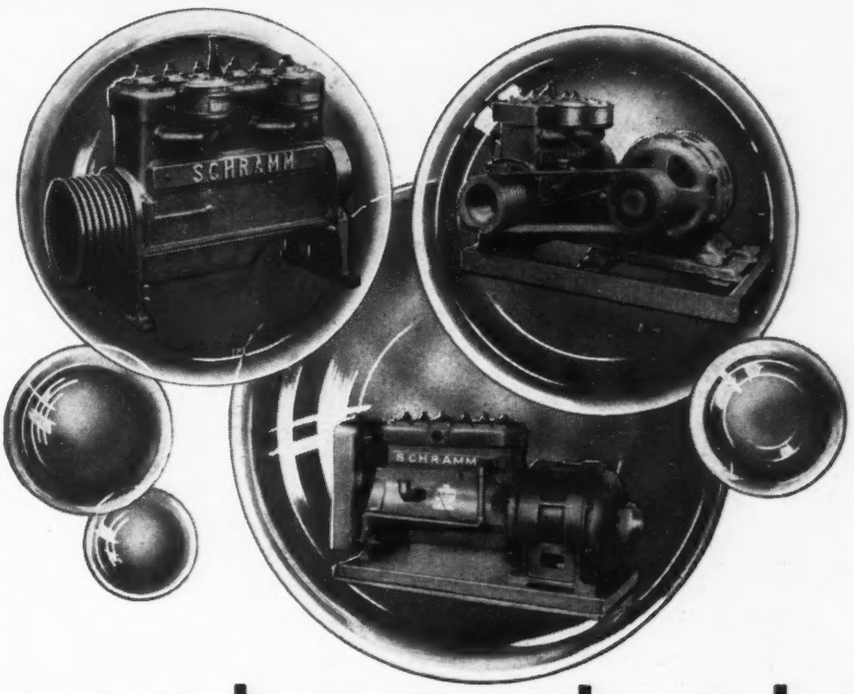
As both a mining engineer and one who has frequent occasion to prepare reports on the valuation of mineral properties, I am naturally interested in the expressions contained in Mr. Boericke's article in the current, January 1947, issue of *Engineering and Mining Journal* with respect to the use of interest rates in valuation computations and in the editorial comments therein on the use of sinking funds in valuation procedure.

I certainly could not take issue with Mr. Boericke's basic idea, which is expressed in the title of his article, but what surprised me is that there should be the least doubt that present low interest rates are (and must be) given consideration in estimating today's value. In any computation involving capitalized earnings, the interest rates then generally prevalent,

*and likely to continue in the future,* are those to be taken into account in estimating the current value of a property. I differ decidedly with Mr. Boericke's belief that engineers in general are continuing "to assume that an interest rate of 4% can be obtained" on sinking-fund payments. The organization with which I am associated has numerous engineers on its staff who are almost constantly engaged in such valuation work, both of mineral and industrial properties, and it has been and is the recognized practice to give full consideration to prevailing interest rates. Furthermore, the usual effect of this does not decrease the estimated value, because it is almost axiomatic that *both* the sinking fund (safe) interest rate and the "risk" (profit) rate will be similarly affected. Consequently, as Mr. Boericke indicates, the capitalized value at 4% and 10% may be practically identical with that computed at 3% and 9%. Our engineers right along have recognized this condition, as there can be no question that the two interest rates are closely interrelated. If, when a "safe" rate of 4% was readily obtainable, a risk rate of 12% or even 15% was considered justified, it necessarily follows that a decline of the safe interest rate, say to 2%, must carry with it some corresponding decrease in the risk rate. It is this condition which Mr. Boericke apparently suggests as a somewhat new consideration but which, I feel confident, is well recognized by practicing valuation engineers.

The editorial comment to the effect that sinking funds are merely theoretical, and consequently might well be disregarded in valuation estimates, is not fully justified, in my opinion. The failure of the purchaser of a property to put into practical effect all the exact details which form the theory on which the value of the property is computed by an engineer does not serve to invalidate that theory and the computations thereunder. The sinking-fund hypothesis is merely one part of a method for estimating value. As the editorial recognizes, the anticipated income must yield not only a certain profit commensurate with the risk involved, but must also provide additional funds to amortize the investment. These amounts for amortization may be still looked on as constituting a sinking fund, in theory, even though the safe interest rate be reduced to zero. This apparently is what the editorial contemplates in practice. Certainly the purchaser may invest the amortization payments in Government bonds, *if he so desires,* and the interest thus obtainable may properly be used as one of the several factors in the computation of value, even though the sinking fund may be more theoretical than actual in the subsequent operation of the property.

BLEECKER L. WHEELER
*Senior mining engineer,*
*Ford, Bacon & Davis, Inc.,*
*New York, N. Y. Jan.* 22, 1947.

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# EQUIPMENT NEWS

## Small, Fast Dirt Mover

Built to answer the need for a small, high-speed scraper unit especially suited to the mining field, the new Model D Tournapull and E-4 Carryall scraper, announced recently by R. G. LeTourneau, Inc., Peoria, Ill., have a load limit of 4 tons, a struck capacity of 3.3 cu. yd., and a top speed of 23 m.p.h. The prime mover is powered by an 85-hp. gasoline engine, and has a new type differential that keeps both wheels pulling at all times, the greater power going to the wheel on the firmer footing.

Control of the Model D is achieved by a revolutionary operating principle in which conventional tractor steering and gear shift levers are replaced by individual electric motors that do all the work. The operator steers, shifts, and handles the scraper by means of buttons on an electrical control panel. The unit can turn in its own length (22 ft., 5 in.); it has a 6-ft. cutting edge, and weighs, empty, 7½ tons.

A new-type 14.00x32 tire, which seats firmly at low pressures, is used on the small Tournapull; 9.00x16 tires are used on the E-4 scraper. Under good conditions in average material, with 60-minute operating efficiency, the new unit, self-loading and one-man operated, can move 48 cu.yd. an hour on 200-ft. one-way haul, or up to 18 cu.yd. an hour on a 5,000-ft. one-way haul. The maker suggests its use for small stripping jobs, mine access-road building, drainage-ditch cutting, reclaiming tailings, building tailings dams, and other mine jobs.

## Long-Wearing Rock Bit

Cemented carbide drill bits, designed and tested for use with ordinary percussion pneumatic rock drills, were announced recently by Kennametal, Inc., Latrobe, Pa. The new Kennametal bits, made in the chisel-type shown in the photograph, have a cutting edge insert of hard, wear-resistant cemented carbide, called Kennametal.

Until the present bit was developed, no cemented carbide bit had been made that could stand the hammering of the ordinary rock drills used in mining, which operate at 80 to 100 lb. per square inch air pressure. The new bit has been thoroughly tested on rock drilling jobs in all parts of the country and has given performance regarded by many as really remarkable. For example, one bit drilled 50 ft. of 1⅜-in. holes in granite at a rate of 1 ft. per minute before it was replaced. It was then ready for resharpening and re-use. The hole at

the end of this run was only 1/32 in. smaller in diameter than the hole drilled at the beginning.

The new bits are manufactured at present in sizes of 1⅜ in. and 1⅝ in. Prices, depending on quantity, are from $8.10 to $9.70 each for the smaller bit, and from $9.50 to $11.40 each for the larger.

## Television Appears

First successful use of television in industry is reported by Farnsworth Television & Radio Corporation, Fort Wayne, Ind., and the Diamond Power Specialty Corporation, Detroit, Mich. These firms collaborated in developing a sight-transmitting system for commercial use. As it is used at Consolidated Edison's Hell Gate plant in New York, the device shows, on a television screen, the water level in a boiler gage located 325 ft. and 8 floors away from the main control room where the screen is placed.

## Outsize Truck

With a gross capacity of 53 tons, the new model 888 Kenworth truck pictured herewith has a 20-yd., water-level, rock type body and a twin cylinder telescopic hoist with a dumping angle of 50 deg. Design features include: an offset cab for greater visibility; Knuckey dual-chain drive bogey; either 295-hp. Hall-Scott gasoline engine or 200-hp. Hercules diesel engine; 14.00x24 tires standard. Power steering is optional, as are 16.00x24 tires for the rear wheels.

## Hose Clamps

A new master kit of Punch-Lok bands that will serve practically every need for clamping or banding rubber hose to nipples or fittings is offered by B. F. Goodrich Co., Akron, Ohio.

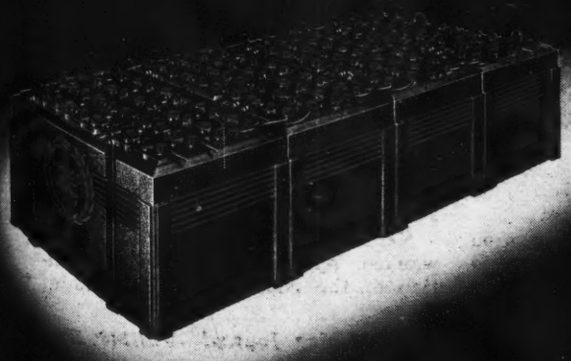
## Low-Temperature Welding

Use of arc welding for alloys, castings, thin metals, and dissimilar sections is said to be facilitated by use of the new low-temperature flux-coated electrodes recently announced by Eutectic Welding Alloys Corpora-

## Power for Greater Production

*To get out more tonnage, at lower cost, equip your hardworking shuttle cars, locomotives and trammers with modern extra capacity Philco Mine Batteries. This extra capacity of 10% or more—an original Philco development—is available in several modern Philco types including the famous long-life Philco "Thirty" Mine Batteries.*

*Write for latest catalog of specification data*



# PHILCO

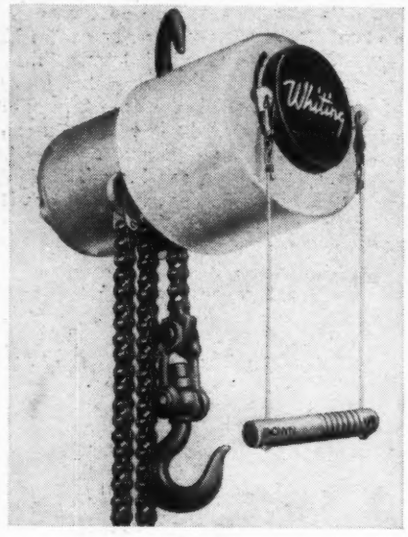
## STORAGE BATTERIES

PHILCO CORPORATION • STORAGE BATTERY DIVISION • TRENTON 7, NEW JERSEY

tion, New York 13, N. Y. Called LowTemp EutecTrodes, the new rods make possible welding at lower base-metal heats. Full details are given in the company's magazine, *Eutectic Welder* for Nov-Dec, 1946.

## Light-Weight Hoist

Light in weight and incorporating unusual features, a new line of roller chain electric hoists of ¼-, ½-, and 1-ton capacities has been announced by Whiting Corporation, Harvey, Ill.




The 1-ton hoist weighs only 87 lb., a lightness that is achieved by using a compact double-reduction, totally inclosed worm-gear drive.

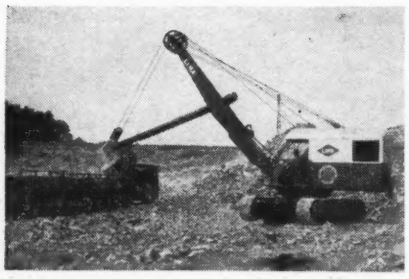
The hoist frame is a steel casting, and the alloy steel roller chain operates over an extra-large sprocket. The load hook swivels on ball bearings, which prevent twisting of the chain. Control is by means of a single bar grip. A patented self-energizing motor brake interlocks with the controller, and upper and lower limit switches are provided.

An unusual feature is that the hoist will operate inverted. Therefore, when the suspension point is high overhead, the hoist's chain can be run up to the point and the load can be suspended from the hoist hook. The hoist will then lift both itself and the load. Ask for Bulletin H-100.

## Shovel-Crane-Dragline

A new 1½-cu.yd. shovel-crane-dragline combination has been announced by Lima Locomotive Works, Inc., Lima, Ohio. Called the Type 604, the new unit has been thoroughly tested under job conditions, and by means of various design features, the manufacturer states, an extra margin of strength and safety has been built into the machine.

The crawler truck construction is the small dolly roller type with end-



drive principle, and each belt is separately driven. The shovel can be steered with the rotating unit in any position. Air control is used for all major functions to assure easy operating. The power plant consists of either a diesel engine or an electric motor of approved make. Full details will be furnished by the manufacturer.

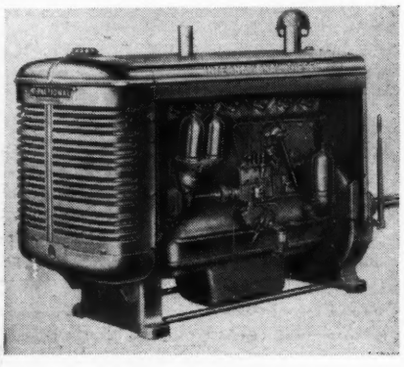
## For Easy Sketching

Properly proportioned drawings can be made without use of ruler, drafting board, or T-square with a new "Jiffy-Sketch" pad now offered by Jiffy Sales Co., 1810½ East 37th St., Cleveland 14, Ohio. The pad measures 9x12 in., contains 75 sheets of unruled high-quality tracing paper, and is mounted in a cardboard folder closed by four flaps. By folding one of the flaps, each of which carries lines ruled according to various scales, under a sheet of paper, quick and accurate sketches can be made in the shop or field. A pad can be obtained by sending a dollar to the company.

## Improved Power Plant

Two new diesel units of increased power with no increase in weight were announced recently by International Harvester Co., Chicago 1, Ill. The 6-cylinder, 4-cycle Model UD-18A develops a maximum of 125 hp. at 1,600 rpm. The 4-cylinder, 4-cycle Model UD-14A develops 76 hp. at 1,600 rpm. Bore and stroke of each are the same.

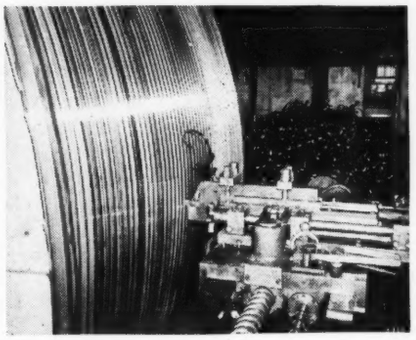
Because the International diesel starting system does not require pre-



heating the incoming air, it has been possible to place the exhaust manifold on the injection side of the engine away from the intake manifold. Incoming air is therefore cooler and volumetric efficiency, or "breathing" ability, is enhanced. These new engines are available in a wide variety of installations and industrial equipment.

## Lime Scale Inhibitor

Calgon, Inc., 323 Fourth Ave., Pittsburgh 30, Pa., announces development of a new series of Micromet feeders by means of which water-treatment chemicals can be fed into water lines in industrial establishments to check corrosion or scale formation. Capacities for scale control run up to 1,000,000 gallons of water per month. The feeders are simple in design, inexpensive, and have no upkeep cost.



**GROOVING the face of a mine hoist drum in the plant of Koppers Co., Inc., Baltimore, Md. Drum is 21 ft. in diameter, nearly 8 ft. wide; grooves are cut for 2½-in. hoist cable. Using Carboloy cutting tools, about 12 tons of chips are removed in the entire operation at a cutting surface speed of 240 ft. per minute.**

## INDUSTRIAL NOTES

**Atkins, Kroll & Co.,** announce removal of their San Francisco office to 520 California St., San Francisco 4, Calif.

**O. J. Schorer,** formerly chief engineer of the rock drill and air tool division of **Worthington Pump & Machinery Corporation,** has been appointed engineering assistant to the manager of the Holyoke Works of the company. **P. H. Nast** replaces Mr. Schorer.

**C. M. Donahue** has been appointed manager of the mining department of **Mine Safety Appliance Co.,** Pittsburgh, Pa.

**Joseph C. Costello** retired on Jan. 1, 1947, as manager of the San Francisco district for **Atlas Powder Co.** after 25 years with the company.

**Nordberg Manufacturing Co.,** Milwaukee, Wis., announces the acquisition of the good will and assets of

**Busch-Sulzer Brothers**, diesel engine company of St. Louis, which will be continued as a division of Nordberg. The company also announces that **D. M. Booth** will represent Nordberg in Mexico City.

**McKiernan-Terry Corporation**, Harrison, N. J., has acquired the good will and assets of the **Mead-Morrison Division** of **Robins Conveyors, Inc.**, which manufactures ore bridges, car dumpers, grab buckets, and similar equipment.

**G. R. Spindler**, formerly with the U.S.B.M., is now consulting mining engineer for **Joy Mfg. Co's.** European subsidiaries.

**Harvey T. Gracely** has been elected president and general manager of **Marion Power Shovel Co.**, Marion, Ohio. **M. V. Cornell** has been appointed sales manager.

**Paul V. Goodman** is the new director of purchases of **Davey Compressor Co.**, Kent, Ohio.

**George H. Kemmer** is managing director and **R. A. Willoughby** is chief metallurgist of the newly formed **Philippine-American Corporation**, a mine examination and development house, located at 1184-D Jakosalem St., Cebu City, P.I.

**W. A. Rundquist** has been appointed sales promotion manager for **Pioneer Engineering Works, Inc.**, Minneapolis, Minn.

**Foote Mineral Co.**, Philadelphia, Pa., announces that its affiliate, **Foote Minerios Industrializados, Ltd.**, maintains offices in Rio de Janeiro and Victoria, Brazil, for ore buying and mining activities.

**W. W. Paape** has been promoted to the post of domestic sales manager of **Euclid Road Machinery Co.**, Cleveland, Ohio.

**Kenneth W. Green** has been appointed purchasing agent for **Electric Storage Battery Co.**, Philadelphia, Pa.

## BULLETINS

**Suction Hose.** Monarch water suction hose for use in mining and construction activities is described in a new bulletin of Hewitt Rubber Co., 240 Kensington Ave., Buffalo 5, N. Y.

**Hydraulic Jacks.** Porto-Power hydraulic jack equipment and pipe benders are described in a new catalog of Blackhawk Mfg. Co., Milwaukee 1, Wis.

**Floor Repair.** Patching of worn concrete, wood, brick, or composition floors with Stonhard resurfacer is described in a new bulletin of Stonhard Co., 403 N. Broad St., Philadelphia 8, Pa.

**High-Strength Steels.** Republic Aldecor, Cor-ten, and Double Strength steels are described in a new 20-page booklet of Republic Steel Corporation, 3100 East 45th St., Cleveland 4, Ohio.

**Mine Turntables.** All-steel turntables for use in mine workings are described in Bulletin 1272 of Atlas Car & Mfg. Co., Cleveland 10, Ohio.

**Research and Testing.** A 24-page booklet of The Dorr Co., New York 22, N. Y., tells the story of the company's engineering services in the fields of chemical, metallurgical, and industrial processing.

**Diesel Engines.** Nearly 100 varied installations of Cummins diesels are described in the first edition of a magazine published by Cummins Engine Co., Inc., Columbus, Ind.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● Illustrated is a Jeffrey haulage type Locomotive hauling a trip of cars in a metal mine operation. This type is built in various sizes up to 40 tons . . . is equipped with anti-friction bearings throughout, contactor control, transverse equalizer air brakes and air sanders.

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# NEW BOOKS

## A New Look at Arabia

**SAUDI ARABIA.** By K. S. Twitchell. Princeton University Press, Princeton, N. J. Pp. 192. Price $2.50.

That portion of the map of the Near East designated as "Arabia" in the atlas has doubtless been vested with mystery for the average person because of the almost complete absence of information about the great "peninsula" afforded by such maps beyond the location of a few cities such as Mecca, Medina and Riyadh, and some ports on the Red Sea and Gulf of Aden. Topographic symbols, or the lack of them, have generally suggested that the region, which is equal in area to half the United States, was desert waste with coastwise mountains.

More recently, the name "Saudi Arabia" also has seemed to call for explanation, this always being withheld, however, as if none were needed. On both counts Mr. Twitchell, in preparing this small and easily read book, has rendered a service to all who would like to get a better understanding of these matters without too much effort. Over a period of 20 years he has had unusual opportunities to see much of the country, its tribes and customs, as well as the status of their economic development. His important role in the activities that led to the organization of the company known as the Arabian American Oil Co. and the enterprise of the Saudi American Mining Syndicate, Ltd. brought him also into contact with the royal house of Saud that rules the country. Thus he has had unique advantages that enhance the value of his observations.

As depicted by Twitchell, Saudi Arabia, the kingdom built step by step since 1901 by Abdul Aziz, or ibn-Saud, when he, the present-day head of the Saud family, was proclaimed governor of Najd, includes besides the great central plateau of the Najd the provinces of the Hejaz and Asir along the Red Sea and that of Hasa on the Persian Gulf. Extending from the boundaries of the Yemen and the Hadramaut on the south more than 1,000 miles north to the boundary of Transjordan, Iraq, and Kuwait, it presents a wide divergence in climate ranging from that of the great desert of the "Empty Quarter" in the south to that of the fertile regions of Asir, where the mountainous areas enjoy 10 to 12 inches of well-utilized rainfall. Water supply and transportation are major problems and, with that of the agricultural possibilities of the country, get the attention of the King himself and his family of officials. Population is put at some 4½ millions by Twitchell, who briefly describes some 20 cities or "centers of national life," including Riyadh, in the Najd, ibn-Saud's capital, as well as the regions in which the nomad Bedouin prefers to live. The chief source of wealth, aside from petroleum and the possibilities offered by mining, has been livestock, though the country has some important agricultural crops, as well as a fishing industry along both west and east coasts, with pearling in addition along the latter. The country is an importing one. Religious pilgrims yield a varying revenue.

The story of the two concessionaire companies already named is told, incidentally, in Chapter 16 on "Oil and Mines." Says Twitchell, "Saudi Arabia is presumably the only country in the world whose development of oil and mining resulted from purely philanthropic sentiment"—that of the late Charles R. Crane, of New York, to whom he pays tribute. The origin of the mining enterprise was parallel with that of oil and connected with it until the end of 1932. Of the 55 ancient gold mines located, only seven were interesting enough to be diamond-drilled, and of these only one, the Mahad Dabad, or "Cradle of Gold," has proved of sufficient size and value to justify developing and equipping with a mining and ore-treatment plant. It is interesting to note that 15% of the Saudi-Arabian syndicate shares was allotted to the Government and an additional 10% was offered for subscription to Arabian nationals and the Government. Over and above this, the Government gets a royalty of 5% of the gross value of metals recovered and paid for (gold, silver, and copper, in concentrates). As for petroleum, exports net the Government 4s. gold per ton. In concluding, the author says "Never in its history has the outlook for Saudi Arabia been so promising." A.H.H.

**INDUSTRIAL PEACE AND THE WAGNER ACT.** By Theodore R. Iserman. McGraw-Hill Book Co., Inc., New York, N. Y. Pp. 88. Price, $1.50.

Anyone who has a feeling that our national labor legislation could be considerably improved ought to be interested in Mr. Iserman's views. In fairly brief space, he points out the defects in both the Wagner Act and the administration of it by the NLRB. He then goes on to suggest remedies. There can be little argument with his thesis that the Wagner Act needs repair, because almost no one will deny that necessity except the labor leaders who have grown fat and powerful under the Act's protection. But there can, and will, be plenty of argument over what to do about the Wagner Act. Whatever your opinion may be, this book is timely and well worth reading.

One serious defect of this book is the author's unfortunate habit of wadding long and involved clauses into the middle of his sentences. The following from p. 63, illustrates the stumbling blocks the reader encounters all too frequently. "Nor on the record of strikes and obstacles to commerce and employment and of the bitter hatred of unions for each other, have working people themselves, forced into unions not of their choice as so many of them have been, reason for uncritical confidence in the Board."

**TECHNIQUE OF EXECUTIVE CONTROL.** By Erwin Haskell Schell. Sixth edition, McGraw-Hill Book Co., New York, N. Y. Pp. 265. Price, $2.25.

**HOW TO SUPERVISE PEOPLE.** By Alfred M. Cooper. Second edition, McGraw-Hill Book Co., New York, N. Y. Pp. 155. Price, $2.00.

These two books might well serve as textbooks in a course in human relations, something that should have been taught in mining schools and so seldom has been. Getting along with people, getting them to do the things you want them to, is of at least equal importance to an engineer or supervisor as his technical knowledge, yet until recently this side of his education has been left to chance. A study of books such as these two could be of great help to both students and practicing engineers and supervisors in remedying this defect.

## PUBLICATIONS RECEIVED

**"Profits in the National Economy."** By Jules Backman and M. R. Gainsbrugh. National Industrial Conference Board, 247 Park Ave., New York 17, N.Y. An analysis of profits and losses from 1909 to 1946.

**"Fluorspar Resources of New Mexico."** Bulletin 21, New Mexico Bureau of Mines and Mineral Resources, Socorro, N.M. Pp. 245, plus 20 separate drawings. Price $2.50.

**"History of the University of Missouri School of Mines and Metallurgy, 1871-1946."** By Clarence N. Roberts, Instructor in History. Rolla, Mo. Pp. 120.

**"The Iron-Ore-Bearing Formations of Ohio."** Bulletin 45. Geological Survey of Ohio, Columbus, Ohio. Pp. 230.

**"The Occurrence of Flint in Ohio."** Bulletin 46. Geological Survey of Ohio, Columbus, Ohio. Pp. 110.

**"Mineral Production of Canada, Preliminary Report, 1946."** Dominion Bureau of Statistics, Ottawa, Canada. Pp. 28.

**Queensland.** "Annual Report of the Under Secretary for Mines for 1939." Pp. 189. Brisbane, Australia.

**Kenya Colony.** Annual Report of Commissioner for Lands, Mines and Surveys for 1945. Published at Nairobi. Pp. 26. Price 1/50s. Also Report No. 10 on "Geology of Migori Gold Belt (South Kavirondo) and Adjoining Areas, with eight separate colored geological maps on scale of 1:25,000. Price 2/50s. for report and 5s. for maps. Also Report No. 11 on "Geology of Country Between Nanyuki and Maralal," with colored geological map. Price 2/50s.

**Union of South Africa.** Annual Reports of Government Mining Engineer for 1941, 1942, 1943, and 1944. Published at Pretoria. Pp. 108, plus a large number of statistical tables as folded inserts. Price £1.

**Southern Rhodesia.** Annual Report of Chamber of Mines of Rhodesia for 1945. Pp. 52.

**Iron.** "Geology of the St. Helens Quadrangle, Oregon." Department of Geology and Mineral Industries, Portland, Ore. Pp. 40. Price 45c. This area contains most of the limonite deposits known in the state.

**Oregon.** Report of Department of Geology and Mineral Industries for period July 1, 1944, to July 1, 1946. Portland, Ore. Pp. 36.

**"Perlite Deposits Near the Deschutes River, Southern Wasco County, Ore."** Department of Geology and Mineral Industries, Portland, Ore. Pp. 17. Price 15c.

**The U. S. Bureau of Mines, Washington, D. C., has issued the following Information Circulars and Reports of Investigations (no charge is made. Address the Director):**

R.I. 3970. "Exploration of O'Jack Mining Co. Zinc and Lead Deposits, Jasper County, Mo." Pp. 39.

R.I. 3971. "Exploration of Barite Deposits in Montgomery County, Ark." Pp. 24.

R.I. 3972. "Exploration of Alunite Deposits, Marysvale, Piute County, Utah." Pp. 74.

R.I. 3973. "Exploration of the Queen Mary Copper Pocket, Missoula County, Mont." Pp. 4.

R.I. 3974. "Exploration of the Cherokee Iron Deposits, Cherokee County, N. C." Pp. 31.

R.I. 3975. "Exploration of the Reward (Vekol) Zinc Deposit, Pinal County, Ariz." Pp. 42.

R.I. 3976. "Preparation of Manganese Electrolyte From Manganese Mattes and Pure Oxides." Pp. 16.

R.I. 3977. "Method of Assaying Oil Shales by a Modified Fischer Retort." Pp. 11. This report represents the results of work done under a cooperative agreement between the Bureau of Mines, United States Department of the Interior, and the University of Wyoming.

## Brazilian Excursion

*Continued from page 64*

searched, the time within which the search will be made; and, worst of all, one had to prove financial responsibility. Brazil might just as well have decreed it to be illegal to search for new mineral deposits.

Brazil's new constitution, written last year, has liberalized the mining code so that anyone can now go prospecting, although with many restrictions. The former shackles on use of foreign capital in Brazil are being relaxed so that foreign investors can, under certain conditions, own the property in which they invest and also take a substantial part of their profits, if any, out of the country.

At present, however, the Government is doing most of the prospecting, although the Hanna Co. is drilling an iron-ore property in Amapa, north of the Amazon, that was discovered only two or three years ago. Only last year, Glycon de Paiva, a Government geologist, found a promising manganese orebody not far from the scene of the Hanna explorations. Bauxite, iron, nickel, manganese, lead-zinc, quartz crystals, mica, diamonds, gold, all have been found over a wide enough area to make it certain that there is more yet to be found.

One great impediment to this search is lack of transportation facilities. There are only two paved inter-city roads in all Brazil, and one of these leads up to the Quitandinha. There are few railroads, and all but the short Central do Brasil are narrow-gage wood-burning lines like the railroad to Itabira. Brazil doesn't have, and can't afford to import, coal for big locomotives, but it does have abundant sites for hydroelectric plants. Electrified railways would be the answer, and once power were available, all sorts of problems could be solved. Brazil's bauxite and its aluminum plants lie idle because the ore lacks means of transportation (as does the Goiaz nickel), and because imported American aluminum costs less than Brazilian metal.

It is the consensus of men who have studied the problem that Brazil's chief need right now is transportation, all the way from bicycles, cars, buses, and trolleys, on up through big trucks, and diesel or electric locomotives. The speed with which this transportation is developed will be a harbinger of, and provide a basis for, Brazil's success in improving the standard of living of its people.

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# REGIONAL NEWS

## TEXAS

### Iron-ore plants soon to resume operation—National Lead buys Texas Mining & Smelting Co.

★Operation of Sheffield Steel Corporation's iron-ore mining and processing plant, west of Jacksonville, will soon be resumed, company officials have announced. The corporation operated the property during the war, along with similar holdings near Linden, but halted production when the plants were declared surplus. The corporation recently bought the Jacksonville property at a war-surplus sale. Upon resumption of operations Leonard Lloyd will again serve as plant superintendent, and, as before, the mined ore will be processed and shipped to a smelting plant at Houston.

★National Lead Co. has purchased the holdings of Texas Mining & Smelting Co., according to an announcement by V. G. Kegler, president of the latter concern. The purchase price was not named. The Texas company is one of the few units in North America engaged in the manufacture of antimony and byproducts. The antimony ores originate in Mexico and are refined at the Laredo plant of the company, which was established in 1930 by F. G. Trowbridge and H. P. Henderson, with the backing of British capital. At the time of the sale approximately 300 persons were employed. It is understood that operations will be continued along the same lines by National Lead, with Kegler serving as manager, both in Laredo and Mexico.

★The old Bird lead and silver properties, southeast of Alpine, have been purchased by Ben B. Scott, of Greenville. Scott is reopening the mines, which he acquired from Mrs. J. C. Bird for $50,000. The mines have been worked intermittently over the last 50 years and were developed on a sufficient scale to determine ore possibilities.

★Chemical and mineralogical studies of the igneous rocks in the Trans-Pecos area are included in an extensive program of geological surveying and fundamental research started by the Bureau of Economic Geology at the University of Texas. Other objectives of the long-range project are complete geological mapping of a large part of the region, search for mineral deposits of value, and interpretation of the geological history. The council of the Geological Society of America recently gave the project a financial boost with a grant of $800, primarily to make possible the study of igneous rocks. The grant will be administered by Dr. J. T. Lonsdale, director of the Bureau. Dr. S. S. Goldich, of the Bureau of Economic Geology, is in immediate charge of the field program.

★Increasing the tax on sulphur from $1.27 to $5 per long ton has been proposed in the State Legislature by five young war veterans, who also seek to raise the production levies on oil and natural gas. It is claimed that the proposed levy would yield $38,000,000 a year.

## TRI-STATE

### Birthday mill shaft will be reopened — Prepare Lucky Jenny mill for operation

★Mine operators in the Tri-State district are concerned over the outlook for continuation of premium payments beyond June 30, 1947, and are hopeful the new Congress will take action favorable to the marginal producer in the interests of national security and conservation. A recent information circular of the U. S. Bureau of Mines states, in part: "The district's production is expected to decline both in total quantity and in proportion of total United States mine output unless important discoveries are made. Ore exposed in mine workings and extensive exploratory drilling done in recent years within and without the productive areas indicate that, although the developed reserves of high-grade ore are no longer large, there are many millions of tons of low-grade rock left that would be commercial under conditions of high prices, large-scale mechanized mining, efficient labor, and the best metallurgical treatment methods. A part of this potential ore is in low-grade deposits in virgin ground, where it would be easily accessible at reasonable cost for use when metal prices are high or during a national emergency. A large part, however, is in floors, roofs, pillars, and edges of mined-out or currently worked orebodies in areas where conditions are such that the ore, if left until after present operations cease and the mines fill with water and cave, would be costly to recover. The principal area of this type is in the Oklahoma-Kansas field, where there are about 15 square miles honeycombed by connected underground workings, nearly all of which must be kept unwatered and the roofs and pillars maintained in safe condition to enable mining to be done in any part. Water being pumped in this area alone amounts to about 14,000 gallons per minute. Should the price of concentrates decline to a point where many lower-grade mines would have to suspend operations, the shifting of the entire maintenance and pumping expense to the remaining higher-grade mines would increase substantially the cost of production, possibly to a level that would progressively close the whole area."

★Preparations are being made by the Marcia K. Mining Co. to reopen the old Birthday mill shaft, northwest of the company's old Lawyers mill, southeast of Picher. The company reopened a field shaft some time ago on the Birthday tract, and has expanded mining and milling operations considerably on the Lawyers property since taking it over more than a year ago. The Birthday mill shaft was last operated more than 15 years ago, when the mill on the site was destroyed by fire. The shaft is being recribbed, and a 300-ton wooden hopper and derrick has been acquired from the Davis-Big Chief Mining Co. Mine operations will be carried on at the lower level, at a depth of around 235 ft. Among those associated in the company are Claude Jones, Louis J. Bowers, Dr. M. A. Connell, and Floyd Bumgartner.

★Harris Mining Co. is completing the reconditioning of the old Lucky Jenny mill, at Hockerville, and expected to start milling operations some time in February, according to Loren Keenan, of Baxter Springs, who heads the company. The mill was last operated by Charles Barnett, of Joplin, as the Mutual Mining & Development Co., during the early part of the war. General repairs and installation of new equipment have been under way at the mill which will have a capacity of about 25 tons an hour. The capacity may be increased later with the installation of a larger crusher, Keenan said. Elmer Smith, who is associated with Keenan in the recent reopening of the Lucky Jack shaft, at Hockerville, will supervise the milling operations. In addition to ore from the Lucky Jack mine, ore will be treated from three properties operated by the Harris company: the Baird mines, south of Cardin; the old Evans-Wallower No.

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## Tri-State *(continued)*

24 lease, northeast of Picher, in Kansas; and the Silver Fox mine, northwest of Treece.

★Charles Roberts, veteran Joplin prospector and miner, and associates are opening a rich zinc-lead mine on the old Robertson land, a 20-acre tract one-eighth of a mile west of Range Line and just south of the Jasper-Newton county line. Carl McDonald, of Joplin, holds the first lease on the tract, and Roberts' associates are Charles McDonald, of Joplin; Elmer Smith, of Carterville; and Frank Burton and Jim Hastings, both of Duenweg. The site of the present mine was originally drilled out last fall by Smith, and sinking operations were started the latter part of 1946. Ore was struck at a depth of 33 ft. in the shaft, which is now down to a depth of 45 ft. in "soft" ground. The last three feet of ore will run about about 35% in blende and nearly 5% in galena, according to Roberts, who described the new development as a "second Little Pat" mine, referring to a rich shallow deposit opened up by the Little Pat Mining Co. in the southeast part of Joplin several years ago.

## COLORADO

### Fires cause damage at several operations — Humboldt claims bought by Telluride Mines

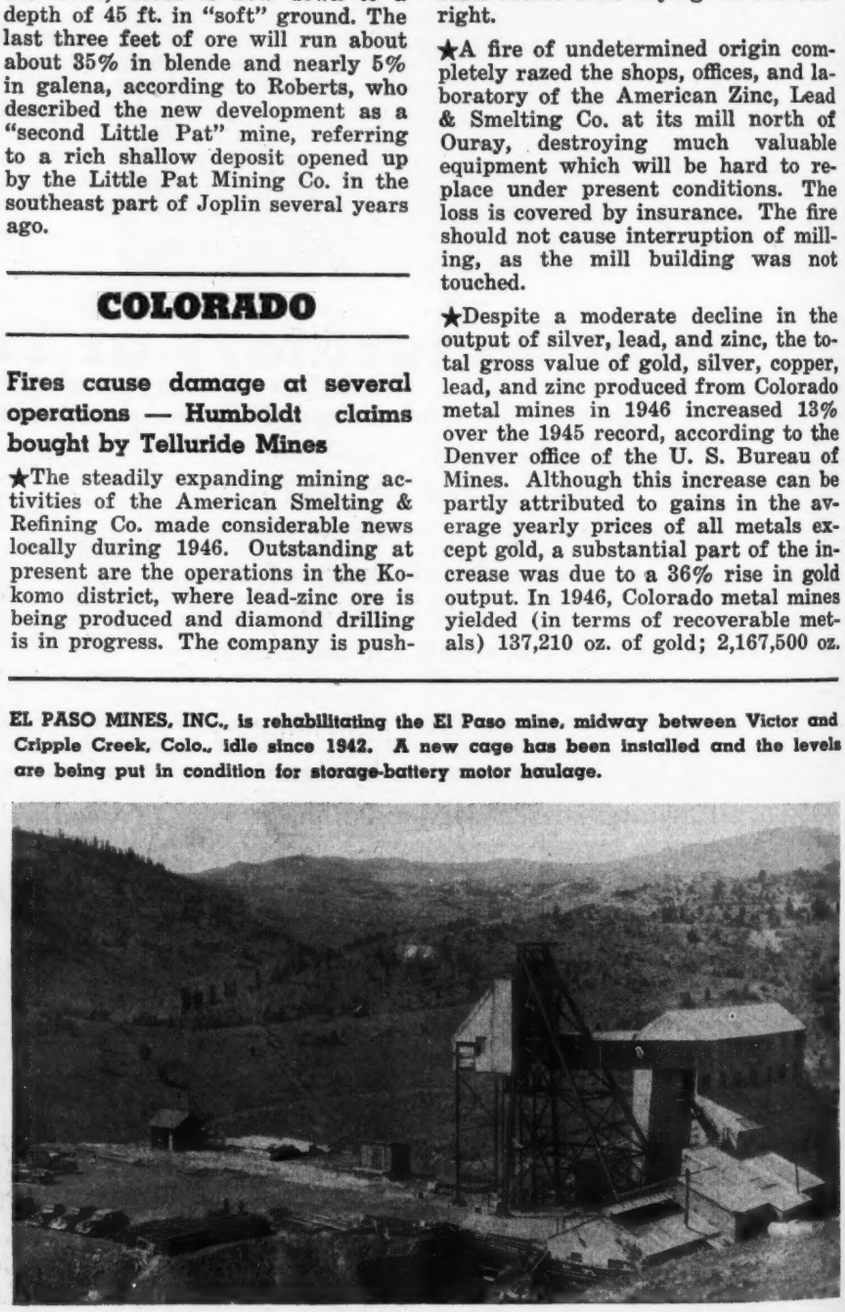
★The steadily expanding mining activities of the American Smelting & Refining Co. made considerable news locally during 1946. Outstanding at present are the operations in the Kokomo district, where lead-zinc ore is being produced and diamond drilling is in progress. The company is pushing operations at the Victory mine, originally known as the Lucky Strike group. In the Leadville district the company has finished work at the Garbutt and is rehabilitating the Eclipse shaft, installing a hoist, and constructing compressor and blacksmith buildings. Placer operations are being conducted near Granite, with James Gibson in charge, and areas are being diamond drilled to determine dredging possibilities.

★The Clear Creek-Gilpin mill is being readied for operation after a three-year shutdown and ore is being stored in the mill bins. Repairs are now being made in the plant, leased to George Stinson and Charles Quinn, who was millman at the Molybenum Corporation of America's operation at Urad. The plan is to operate as a custom mill, treating ore on a per-ton charge basis rather than buying the ore outright.

★A fire of undetermined origin completely razed the shops, offices, and laboratory of the American Zinc, Lead & Smelting Co. at its mill north of Ouray, destroying much valuable equipment which will be hard to replace under present conditions. The loss is covered by insurance. The fire should not cause interruption of milling, as the mill building was not touched.

★Despite a moderate decline in the output of silver, lead, and zinc, the total gross value of gold, silver, copper, lead, and zinc produced from Colorado metal mines in 1946 increased 13% over the 1945 record, according to the Denver office of the U. S. Bureau of Mines. Although this increase can be partly attributed to gains in the average yearly prices of all metals except gold, a substantial part of the increase was due to a 36% rise in gold output. In 1946, Colorado metal mines yielded (in terms of recoverable metals) 137,210 oz. of gold; 2,167,500 oz.

**EL PASO MINES, INC., is rehabilitating the El Paso mine, midway between Victor and Cripple Creek, Colo., idle since 1942. A new cage has been installed and the levels are being put in condition for storage-battery motor haulage.**



of silver; 2,984,000 lb. copper; 33,746,000 lb. lead; and 67,636,000 lb. zinc. Production in 1945 was 100,935 oz. of gold; 2,226,780 oz. of silver; 2,970,000 lb. copper; 34,088,000 lb. lead; and 1,546,000 lb. zinc.

★The Humbolt Leasing Co., in which are associated George Mulvey, of Ouray, and Frank Yates and Joe Little, of Denver, has sold the Humbolt group of 9½ claims to Telluride Mines Co., of Telluride, for a consideration of $70,000. This property is undercut by the Smuggler workings in Telluride Mines, and the ore is taken out on the Telluride side to be treated at the Smuggler mill. The Telluride Mines Co. has already spent $75,000 or more in developing the Humbolt group from the Telluride side.

★The Golden Cycle mill, at Colorado Springs, in 1946 treated gold ore from the Cripple Creek district valued at $1,873,898, compared with $1,100,000 in 1945. Last year's tonnage totaled 299,647, an increase of 170,147 over the 1945 figure. The mill also treated 7,192 tons of ore from other districts, boosting the 1946 total to 306,839 tons. The bulk of the Cripple Creek district output, all of which went to the Golden Cycle plant, was recovered from mines operated by Golden Cycle Corporation, the Portland and Vindicator mines operated by United Gold Mines Co., and the Stratton Estate group operated by lessees.

★The U. S. Bureau of Mines has a crew of eight men rehabilitating and retimbering in the old Smuggler properties, at Aspen, to assist operators in finding bodies of ore that can be worked profitably.

★Work at the Red Elephant mines, near Lawson, has been resumed after the war shutdown. Charles Hull, of Idaho Springs, is mine superintendent and O. J. Cross, also of Idaho Springs, is mill superintendent. A 200-ft. crosscut will be run from the tunnel, starting at a point about 1,900 ft. in from the portal, to open the Tabor and St. James veins.

★Fire struck a serious blow at Gunnison County's mining industry when the new mill of the Forest Queen and the Ruby King silver mines burned, halting further progress of the $500,000 mining operation. The fire caused $75,000 damage, which included complete destruction of the mill and new machinery installations. Shafts at both mines were burned down to 60 ft. below the collars. The fire originated in an oil stove. The loss was only partly covered by insurance.

★The directors of Rico Argentine Mining Co., largely held by Utahans and operating the Rico Argentine zinc-lead-copper properties at Rico, have declared a dividend of 5c. a share totaling $40,000.

★Carter Mines Co., operating the Carter mine, four miles north of Ohio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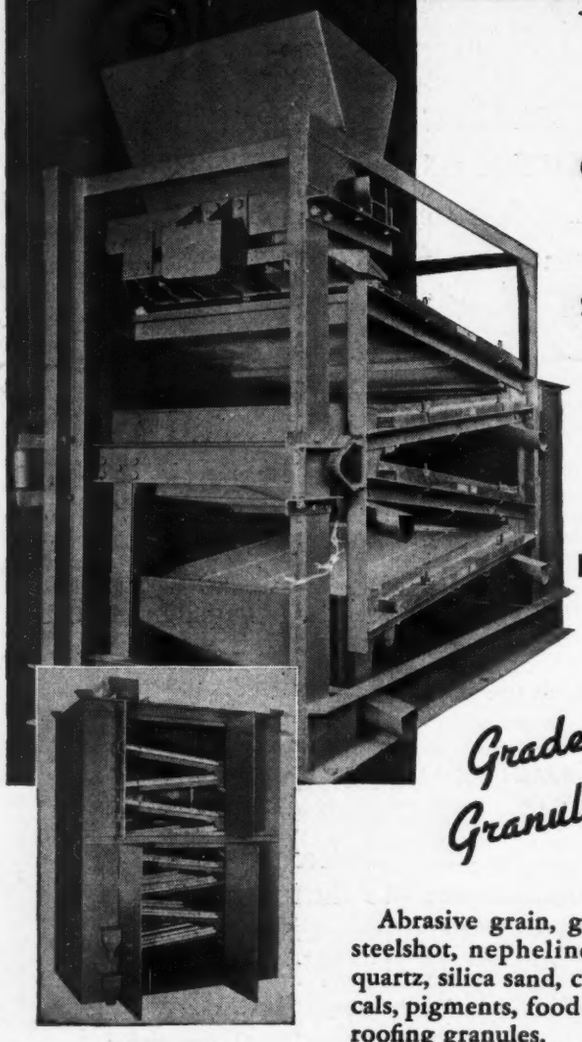

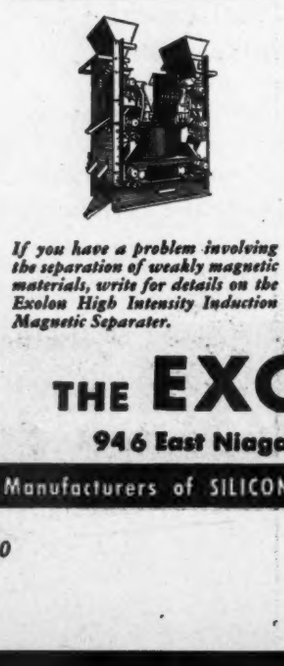

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## Colorado (*continued*)

City, is working on a 50-ton daily basis with 25 men employed in the mines and mill. A 20-hp. diesel engine was recently installed to supplement present water power. Pay values in the ore are silver, gold and lead.

★Gold-copper-silver ore is being trucked from the Malachite mine, nine miles southwest of Golden, to the Black Eagle mill, at Idaho Springs. Reginald M. Moore, of Idaho Springs, and G. G. Gowan, of Fort Worth, Tex., operate the mine under lease. The mine is owned by Colorado-Kansas Syndicate, of Wamego, Kan.

★The total value of metals produced from Summit County mines increased 26% in 1946. About 23 mines, including 5 placers, were in operation in 1946, compared with a total of 19 in 1945. Summit County ranked third in zinc production and fifth in lead production for the State in 1946. The Kokomo unit of American Smelting & Refining Co., largest producer in the county, shipped ore to the Leadville milling unit. Wilfley Leasing Co., operated throughout the year, shipping ore to the Resurrection mill at Leadville. Kimberly Mines, Inc., also shipped steadily to the Resurrection mill.

★After three months' development work in the old Revenue mine, above the Pennsylvania mine, on West Argentine Pass near Breckenridge, Robert Sayre, Jr., is said to have opened a body of $100 ore carrying 78 oz., silver, 12% lead, 6% copper, and 4% zinc. The vein at last report was 30 in. wide.

★John H. McElroy is in charge of operations at the Raymond mine, near Ohio City, where the Ore & Chemical Corporation is doing development and exploration work. A 75-ton mill was started up the last week in January. Diesel power is used for the compressor and generator at the property.

★The Denver mint reported receipts of 49,512 oz. gold in January, a 40% increase over the same month in 1946. Silver receipts amounted to 10,303 oz., slightly below the total of a year ago.

## MONTANA

### Mining Association urges more prospecting aid from State

★The Mining Association of Montana held its seventh biennial legislative meeting at Helena on Jan. 23. Dr. Francis A. Thomson, of Butte, and W. R. Allen, of Wise River, were co-chairmen. M. I. Leydig, of Helena, brought in a report as chairman of the Access Roads Committee, and Ted Collins, of Helena, submitted a report as chairman of the Public Lands Committee. In a brief ceremony Dr. Thomson bid farewell to E. McL. Tittmann,

manager of the East Helena plant of the A. S. & R. Co., who will become manager of the company's El Paso plant, and welcomed to Montana Kuno Doerr, Jr., Mr. Tittmann's successor, who has been assistant manager of the Utah department of the company.

The meeting then resolved itself into a committee of the whole to pass resolutions, which urged the State Legislature to increase the present appropriation of $25,000 per year to the Montana Bureau of Mines and Geology, so that help could be given to the prospector and small-mine operator to increase the mineral production of Montana. Dr. Thomson, Director of the Bureau, and his staff were highly complimented for the aid they now are giving to the small-mine operator and prospector. A resolution was also passed authorizing Carl J. Trauerman, secretary, to present the views of the Association on modification of security regulations before forthcoming hearings of the Securities and Exchange Commission.

★It was reported, with good foundation, that the office and records of the Cadastral Engineer, of the Bureau of Land Management of the Department of Interior, now in Helena, was to be moved to the regional office of the organization at Billings. The records of patented mining claims are in the Helena office, and, as these records are frequently used by the mining industry, which is mainly in the western part of the State, the Mining Association of Montana strongly protested moving the office to Billings. The U. S. Department of the Interior, after being contacted by the Montana congressmen, stated that the Helena office would not be moved to Billings, at least not in the immediate future, as had been reported.

## UTAH

### Mining leaders demand Premium Price Plan substitute—Four companies sued for portal pay

★The War Department informed Representative J. W. Robinson on Jan. 11 that it has abandoned plans for a permanent experimental range for guided missiles in the desert area of western Utah. Utah mining interests had protested withdrawal of a 200-mile long area south of Wendover on grounds that it would hinder mining development and production.

★Some automatic, simple subsidy plan which would permit most metal mines to continue operations and foster exploration and development is needed to replace the present Premium Price Plan scheduled to expire June 30, a group of mining leaders agreed Jan. 15 at a meeting in Salt Lake City.

Elmer Isern, vice president of Eagle Picher Mining & Smelting Co., Joplin, Mo., voicing the opinion of high-


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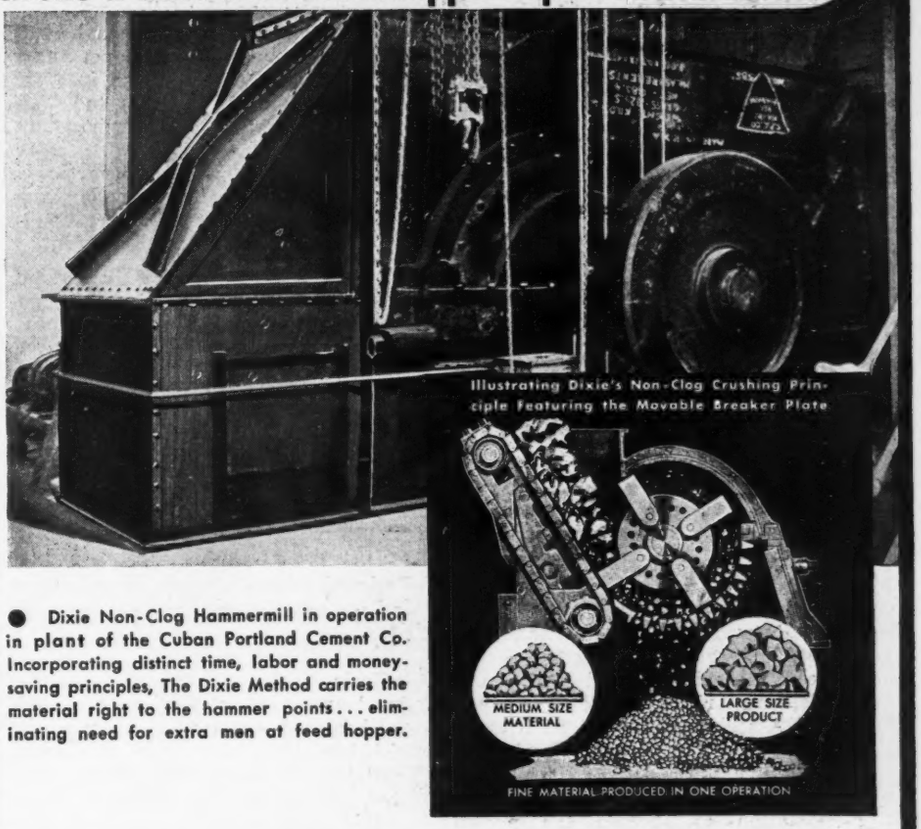
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## Utah *(continued)*

cost producers from all the Western states, said: "More than half the domestic producers of zinc, lead, and copper will be hampered seriously and many others forced to suspend operations if the present subsidy program is ended without some suitable legislative substitute."

H. A. Gray, another vice president of Eagle-Picher, said that ending of the premium program without a suitable substitute would remove from markets 30% of the domestic zinc and 10% of the domestic lead through virtual closing down of the Tri-State district.

Others attending the session included Robert S. Palmer, secretary, and B. T. Poxson, president, Colorado Mining Association; Carl J. Trauerman, secretary, Mining Association of Montana; Harold Worcester, Telluride Mines Co., Telluride, Colo.; E. R. Shorey, president, Wisconsin, Illinois, and Iowa Zinc & Lead Ore Producers' Association; W. W. Lynch, Calumet & Hecla Consolidated Copper Co., Calumet, Mich.; Charles Dunning, director, Arizona Department of Mineral Resources; O. W. Bilharz, president, Tri-State Zinc & Lead Ore Producers' Association; and Sam Coupal, president, Arizona Small Mine Operators' Association. James K. Richardson, manager, and E. H. Snyder, immediate past president of Utah Mining Association, helped draft proposed legislation to succeed the present subsidy plan.

★Phosphate lands in Utah held by the Federal Government since 1938 have been returned to the State by an order of the Department of the Interior, H. Byron Mock, regional administrator, Bureau of Land Management, Salt Lake City, announced Jan. 21. Areas affected by the release include deposits on the north and the south flanks of the Uintah Mountains and the eastern flank of the Wasatch Range, which will now be open for mining development.

★Total value of copper, lead, zinc, gold, and silver mined in Utah during 1946 was $55,427,860, compared with $90,018,641 in 1945, according to preliminary figures released by the U. S. Bureau of Mines. The mine strike, which lasted through most of the first half of the year, was blamed for much of the reduction. A new 1,500-ton tailings plant of Pacific Bridge Co., at Park City, is among the new operations noted.

★Fatalities in Utah mines dropped from 58 in 1945, to 17 in 1946, the State Industrial Commission announced Feb. 4. Of last year's 17 deaths, 15 were in coal mines, one fatality was in a gilsonite mine and one in a rock asphalt quarry. The 1945 figure included 23 coal miners who died as a result of an explosion at the Sunnyside mine.

★Trapped for six hours behind more than 100 tons of rubble following a cave-in Jan. 25 on the 1,300-ft. level of the Gemini mine, near Eureka, two men were rescued by fellow workmen. The cave-in occurred when a loading chute went out of control, pouring a large amount of loose ore into the shaft, mine authorities reported. William Bridgeman, mine superintendent, directed the rescue work.

The Gemini mine, in the northwest section of Eureka, is now under lease by Chief Consolidated Mining Co. to Duke Page and Brennan Hannifin.

★Portal pay suits against Silver King Coalition Mines Co., Park Utah Consolidated Mines Co., New Park Mining Co., and American Smelting & Refining Co., asking for sums ranging up to $2,275 per employee, have been filed in the district court.

# IDAHO

### Federal plans deepening Galena shaft—Silver Syndicate preparing for production

★Hecla Mining Co. has joined in the development of a new mineral belt southeast of Wallace by the purchase of 131 mining claims. totaling approximately 6,020 acres. The group is situated on Rock Creek, between Wallace and Mullan, and extends in an east-west line covering territory some three miles long by two miles wide. The company has not yet decided on any definite plan of development, said L. E. Hanley, president and manager, in announcing the deal, but has obligated itself to sink at least 200 ft. on the Gem State property. This shaft will probably be so sited that it can be used in future development.

★Coeur d'Alene Mines has unexpectedly developed an orebody on the 2,000 level while engaged in driving a drift to obtain waste rock for stope filling. The drift was along the strike of the Coeur d'Alene Mines vein easterly to a point where the vein had pinched out on all levels. After carrying through the Coeur d'Alene Mines fault the work exposed a small streak of rich ore which widened out to 11 ft. An average assay across this width ran 83 oz. silver. Drifting to date totals 25 ft. Progress is slow because of heavy ground.

★Vindicator Mining Co., operating in the silver belt east of the Lucky Friday mine, at Mullan, has opened a mineralized shear zone, similar in character to the Friday zone, in two crosscuts 250 ft. apart. Assays on the ore run 23.4 oz. silver, 6.5% lead, 9.7% zinc, and 1.65% copper.

★American Smelting & Refining Co., through its local subsidiary, Federal Mining & Smelting Co., announces that it has taken a contract to sink the Galena shaft in Lake Gulch, west of Wallace, an additional 2,200 ft. to sea-level depth of 3,000 ft. The work is being undertaken in collaboration with Vulcan Silver-Lead Mining Co., recently organized in New York, which has taken over 58 mining claims owned by the Callahan Zinc-Lead Mining Co., including the Galena mine and shaft. This deep development by A.S.&R. is to explore for orebodies developed at depth in the silver belt farther west.

★Clayton Silver Mining Co. has purchased the townsite of Clayton and the Ella group of mining claims, in Custer County, from Ford Motor Co., which owned them in connection with its Red Bird mine holdings. The latter property has been sold to a Salt Lake City corporation.

★The 300-ton mill of the Triumph mine, at Hailey, was destroyed by fire on Jan. 18. The loss runs into several hundred thousand dollars. The company is shipping ore direct to Salt Lake City for treatment until a new plant can be erected. The Triumph mine employs 300 men and is said to be the largest silver-lead-zinc mine in Idaho outside the Coeur d'Alene area.

★Silver Syndicate Mining Co., half of which is owned by Sunshine Mining Co., is preparing to start regular production, according to W. M. Yeamen, president. During the recent period of short manpower the company has opened stoping ground on a portion of the Chester vein, and has developed another vein several thousand feet to the west which is 12 ft. wide and assays 47 oz. silver and 22% lead per ton. This development is at a depth of 3,700 ft.

★Idaho has the largest antimony mine in the United States, according to Hary W. Marsh, secretary of the Idaho Mining Association. The Yellow Pine mine, at Stibnite, owned by the Bradley Mining Co., employs 200 men. During World War II this mine produced 95% of domestic antimony supplies.

"Due to the recent completion of an expansion program at the Yellow Pine," said Marsh, "and also to the present high price, the domestic mine production of antimony is now at the highest level in history. Practically all of this production is from Idaho mines.

"The Yellow Pine mine is producing at the rate of 6,000 tons of antimony annually. Recent improvements in the flotation plant, the installation of a 9½x12-ft. Marcy rod mill, and completion of a 300-ton-per-hour crushing plant have increased the mill capacity to 2,400 tons per day. A low-grade antimony-gold ore assaying 1.25% antimony, 0.8 oz. gold, and 0.6 oz. silver per ton is being mined at the company's open pit, 2½ miles north of the mill. The new crushing plant is

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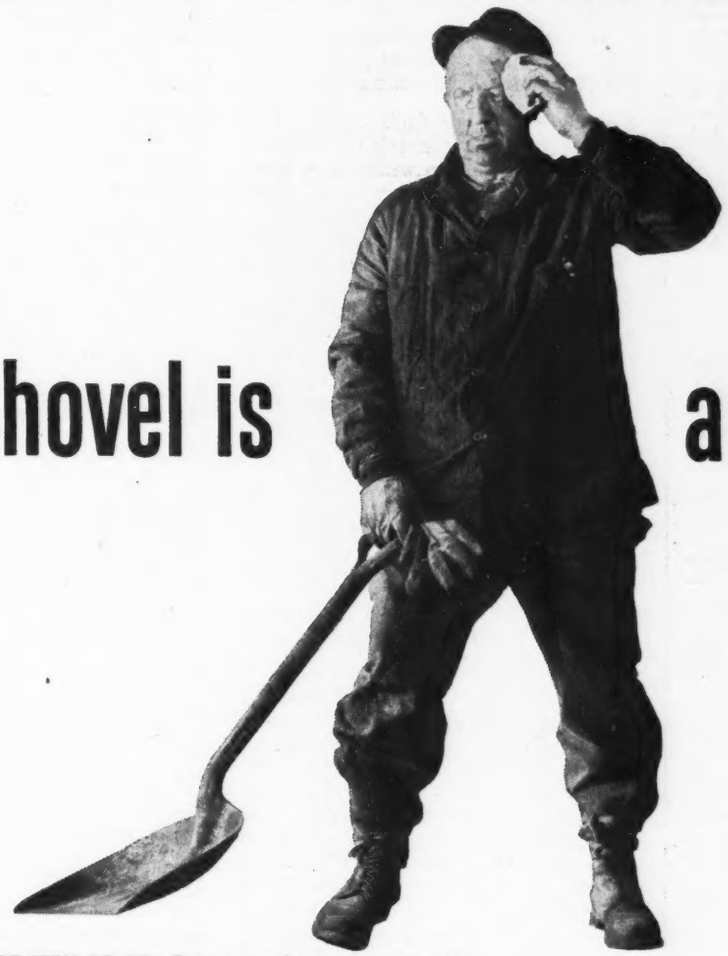

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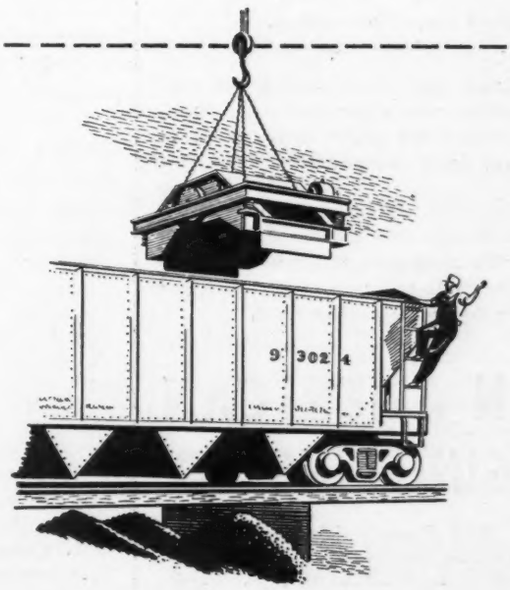

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## Idaho *(continued)*

in the open pit and crushed rock is conveyed up a vertical distance of 200 ft. for truck haulage to the mill."

★Sunshine Mining Co.'s Yankee Girl vein system is developing into an ore-producing structure which may rival the parallel Yankee Boy vein, which yielded some $25,000,000 in dividends. The Yankee Girl vein is divided among three companies. In opening up ground west of the Metropolitan crosscut on the 3,100-ft. level Sunshine has drifted on the vein a distance of over 1,000 ft. in ore averaging around 20 oz. silver and has recently started a raise in this area which assayed, a short distance above the tunnel level, 46.7 oz. silver per ton.

★The new Nabob mill, on Pine Creek, is treating 150 tons of ore per day. Officials believe the mill feed will average more than 8% in combined lead and zinc minerals. The ore is trucked to the mill from upper workings pending the completion of a long mill-level adit opening.

★Hecla Mining Co. has declared its first dividend of 25c. a share for 1947, payable March 15 to stock of record Feb. 15, and amounting to $250,000. This brings Hecla's total dividend disbursements to $30,155,000. The company still maintains the Hecla mine plant at Burke because of its half interest in the Star mine, which is worked through the Hecla shaft. Hecla is now winding up a tailings operation at Osburn, west of Wallace, which has involved the milling of 3,000,000 tons of old river tailings. The company also owns the controlling interest in the Polaris mine.

## WASHINGTON

### State's metal value up, volume down in 1946 — Cleveland mine stepping up production

★Portal-to-portal suits totaling about $2,000,000 were filed in Spokane federal court against Washington mining companies during January. The action against Pend Oreille Mines & Metals Co., near Metaline Falls, asked $282,000; against Howe Sound Mining Co., at Holden, $612,000; against American Zinc, Lead & Smelting Co., operating in the Metaline district, $766,000. Harlow Wildman, international organizer for International Union of Mine, Mill and Smelter Workers (CIO), was listed as one of the plaintiffs in each of the three suits. Small groups of employees were listed as plaintiffs "in behalf of themselves and as agents and representatives for and in behalf of all other employees." In the cases of the Howe Sound and American Zinc, Lead & Smelting Companies the contention is that the men have worked 46 hours in place of 40 hours each week. A $325,000 suit was brought against the Kaiser aluminum plants at Trentwood and Mead, by the United Steelworkers of America, (CIO). It is charged that the men worked 3 hours and 20 minutes more than the 40-hour work week.

★One potline will be in production at Kaiser's Tacoma aluminum plant March 1, according to Norman L. Krey, works manager. Another will start soon afterward, and plans are to have the plant in full production by April 1. General Contracting Co. is reconverting the plant and employing 225 men in two shifts.

★A report on pumice and pumicite in the State has been released by Sheldon L. Glover, supervisor of the Washington State Division of Mines and Geology. The two chief areas of pumice occurrence are at Mount St. Helens, in the western part of the State, and Glacier Peak, northwest of Wenatchee. The pumicite, or volcanic ash, is found chiefly in the eastern part of the State, where there are some producing pits as well as deposits which have been tested.

★American Zinc, Lead & Smelting Co. is installing a hoist at the Grandview mine, near Metaline Falls. An opening drilled through one of the large glory holes is being used to install the heavy piece of machinery underground.

★Chief Justice Joseph Mallory has issued an order for rehearing by the State Supreme Court of the State's appeal for $135,318.76 in royalties from the Northwest Magnesite Co., of Chewelah. The royalties were allegedly due under terms of a written contract for mining operations on 40 acres of State school lands. The State was awarded $10,940.88 in royalties, in 1943, by Superior Judge M. E. Jesseph, of Stevens County, but the decision was appealed to the Supreme Court for the full amount.

★Chelan and Pend Oreille counties took the lead in the State's metal production in 1946. They were the only counties to exceed $1,000,000 in total value of the five metals produced, according to the U. S. Bureau of Mines report. The total value of these metals in 1946 was $7,319,380, compared to $7,140,242 in 1945, but the production of all metals declined. Gold decreased 6%, silver 8%, copper 9%, zinc less than 1%, and lead 21%. A two-month strike at American Zinc, Lead & Smelting Co. and Metaline Mining & Leasing Co., in the Metaline district, resulted in an estimated loss of some 2,000,000 lb. of zinc and 800,000 lb. of lead.

★Base Metals, Inc., is employing two shifts at its 100-ton mill at the Cleveland mine, in Stevens County, and expects soon to add a third shift. The lead-zinc concentrates, also containing some silver, are sent to the Sullivan zinc plant, at Silver King, Idaho and the Midvale smelter, in Utah. C. L.

Miles is general manager of the mine.

★The 20th Annual Mining Institute, under direction of Dean Milnor Roberts, met Jan. 16 at the College of Mines, University of Washington, and was attended by more than 300 men and women. Frank Woodside, of the British Columbia Chamber of Mines, Vancouver, discussed the laws governing prospecting and staking in his province. Other discussions dealt with fuel, mine expansion, nickel, steel, aluminum, magnesium, pumice, ceramics, zinc and the H. H. Sink-Float process of mineral separation.

★George H. Waterman was appointed in January by M. H. Van Nuys, president of West Coast Mineral Association, of Seattle, to act as chairman of a committee to meet with the Krug Mining Committee for a conference in Spokane concerning mining problems of the Pacific Northwest and Alaska. Waterman urged that Alaska Miners' Association cooperate with the West Coast Mineral Association in sending representatives to Spokane.

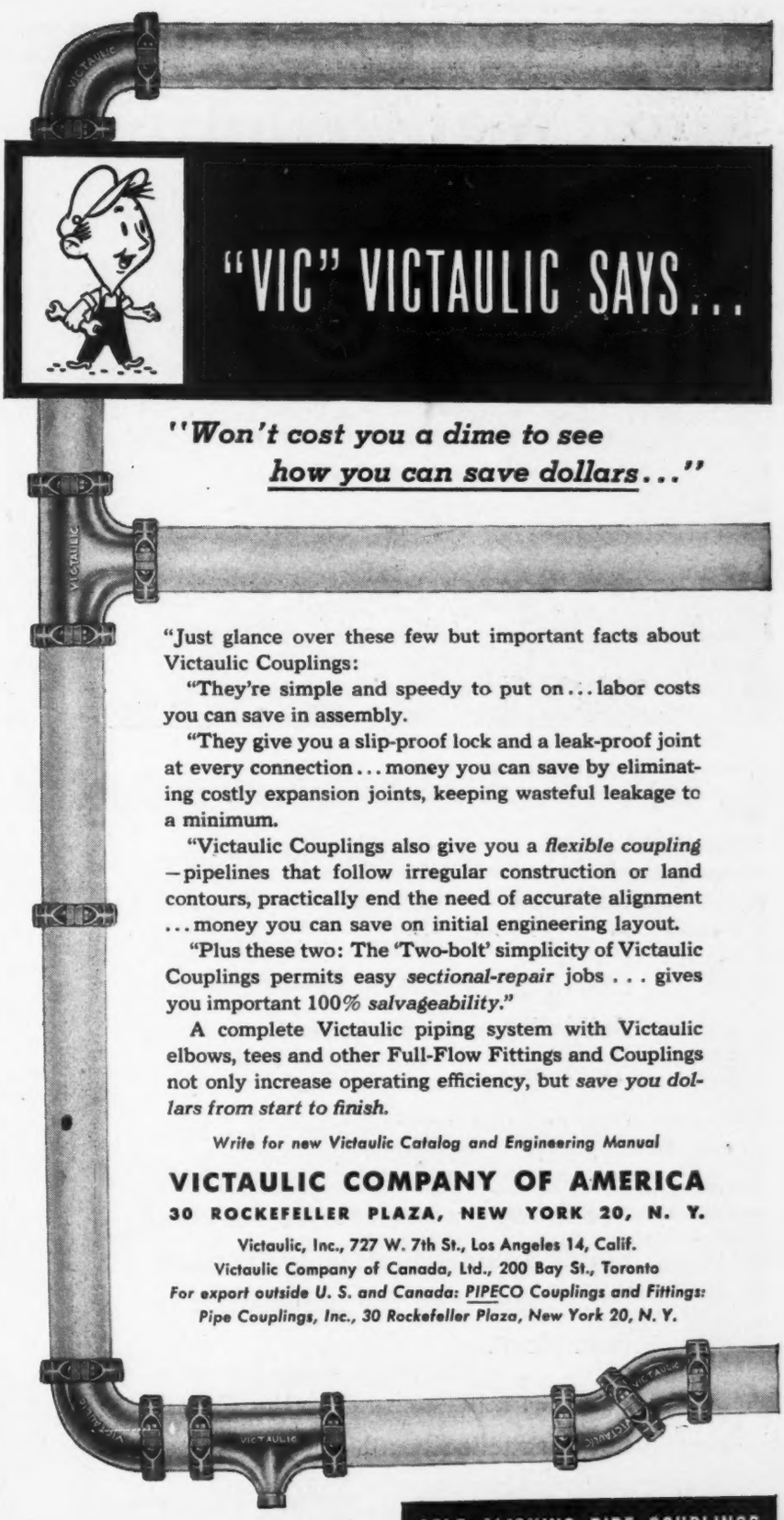
## NEVADA

### Orion Consolidated will reopen Bullfrog properties — Enlarged Getchell mill to resume

★Nevada in 1946 ranked second to California in production of quicksilver, according to a statement by Matt Murphy, State Inspector of Mines. The bulk of the State's mercury output came from the 80-ton furnace plant of the Cordero Mining Co., in Humboldt County. Because of the drop in price, the plant was closed down early in January. Samuel H. Williston is executive vice president of the company, a subsidiary of the Sun Oil Co., of Philadelphia.

★The four-compartment "Fad" shaft of the Eureka Corporation, Ltd., on Ruby Hill, sunk to develop lead-zinc-silver-gold orebodies revealed by deep drilling at 2,400 to 2,700 ft. of depth, had passed the 1,500-ft. point early in February, George W. Mitchell, manager, stated at Eureka. It is reported that the old Diamond and Excelsior mines on Prospect Mountain, two miles south of Ruby Hill, were to be reopened by the Consolidated Eureka Mining Co., headed by James E. Hogle, of Salt Lake City, and with Carl Stehle, Sr., of New York, a director.

★Old mines at Bullfrog, productive in the boom period of 40 years ago, including the Montgomery-Shoshone, controlled for some time by the late Charles M. Schwab, and the adjoining Polaris and nearby Gold Bar, have been acquired by the newly organized Orion Consolidated Mines Corporation, with main office in Reno and field office at Beatty, southern Nye County,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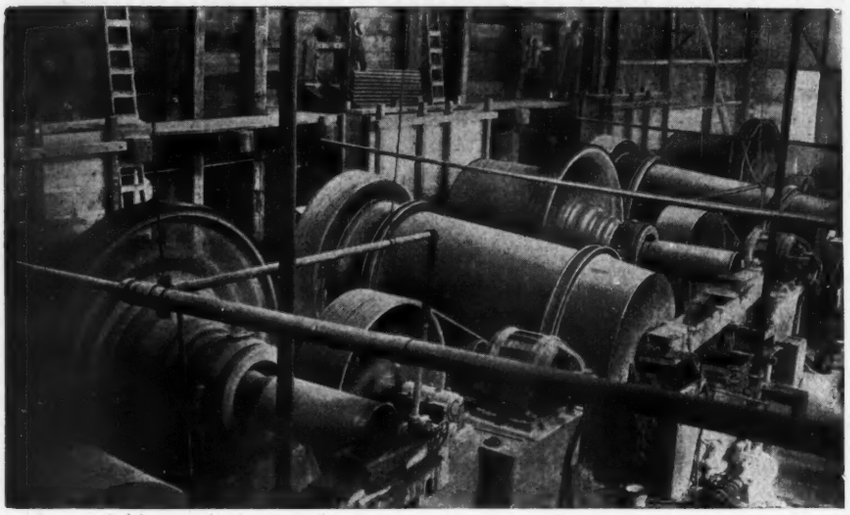

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## Nevada *(continued)*

near the mines. Workings of the Montgomery-Shoshone and Polaris are to be reopened and a surface mass of low-grade gold ore on the Gold Bar, described in a U.S.G.S. bulletin, will be sampled with a view to open-cut mining. W. J. Loring, now reopening the Belmont mine, at Tonopah, is president of the Orion company.

★Equipment of the compressor house at the Silver Pick shaft at Goldfield, center of activities of the Newmont Mining Corporation's Esmeralda operation, has been replaced following recent damage by fire. The 1,300-ft. shaft had been repaired to the 700-ft. level, where lateral work had started when the work was halted, reportedly to await the delivery of additional equipment. Units received lately include diamond-drilling equipment. Newmont is reopening the productive Florence mine.

★Reports have indicated that the Getchell Mine, Inc., mill, now enlarged to treat 1,500 tons per day and provided with a primary flotation circuit, would resume operating on a part-capacity basis late in February. New metallurgy, it was said, eliminates the costly ore-roasting procedure. A three-compartment shaft is being sunk at a point 3,000 ft. north of the open-cut and tunnel workings. Roy A. Hardy, with office in Reno, is directing engineer.

★Construction of a tungsten concentrator is in progress at the mine of the Nevada Scheelite Co. near Rawhide, Mineral County, replacing the former plant, built in two units at Dead Horse Well, 8 miles to the south, which was destroyed by fire some months ago, together with camp buildings. Arthur Mills, manager at Rawhide, said an 8-mile pipe line was being laid from new wells.

★Diamond drilling on the property of the Grand Deposit Mining Co. in the Silver Mountain district, White Pine County, is stated by Paul C. Lyon, of Salt Lake City, president, to have exposed ore in undeveloped ground. Buildings destroyed by fire have been replaced.

★Silver bars weighing 1,200,000 lb., loaned by the U. S. Treasury to Basic Magnesium, Inc., as a substitute for copper during the war, are being returned to the mint at Denver, it was said at Las Vegas by M. A. Hancock, in charge for the RFC.

★Shipment of manganese ore is to be resumed following repair of roads from the Black Diablo mine, in the Pumpernickel district, northern Pershing County. During the war a substantial volume of ore was shipped from the Golconda station, on the Southern Pacific, to the Geneva Steel Co., in Utah. Some 65,000 tons have been produced to date. Pat Devine, of Golconda, is in charge.

★Test drilling has been conducted by

California men on a wide area of detrital placer ground in lower Tule Canyon, southern Esmeralda County, to ascertain dredging possibilities. F. I. Green, of Sacramento, has directed the work, conducted by means of churn drilling and prospect shafts. The region, near Death Valley, has produced many good nuggets.

★Diamond drilling of unexplored sections of the formerly productive Panamint vein, near Austin, has been in progress under contract for the Nevada Equity Mining Co., controlled by heads of the Copper Canyon Mining Co., both operating in Lander County. The Hillside shaft on the Panamint vein, productive in the early days of the Bonanza silver district, has been repaired approximately to the horizon of the 1,700-ft. Equity tunnel, lately cleared and repaired. Robert H. Raring is vice president and directing engineer for both companies and W. L. Peterson is foreman in charge of operations at Austin.

★The main office building, assay shop, and other surface units on the property of Alexander & Brooklyn Mines Co., operating the Webster and other mines at Grantsville, northern Nye County, were destroyed by fire recently with heavy loss of equipment and records, partly covered by insurance. Preparations were under way to increase capacity of the flotation mill from 50 to 100 tons. Mine work was not interrupted by the fire.

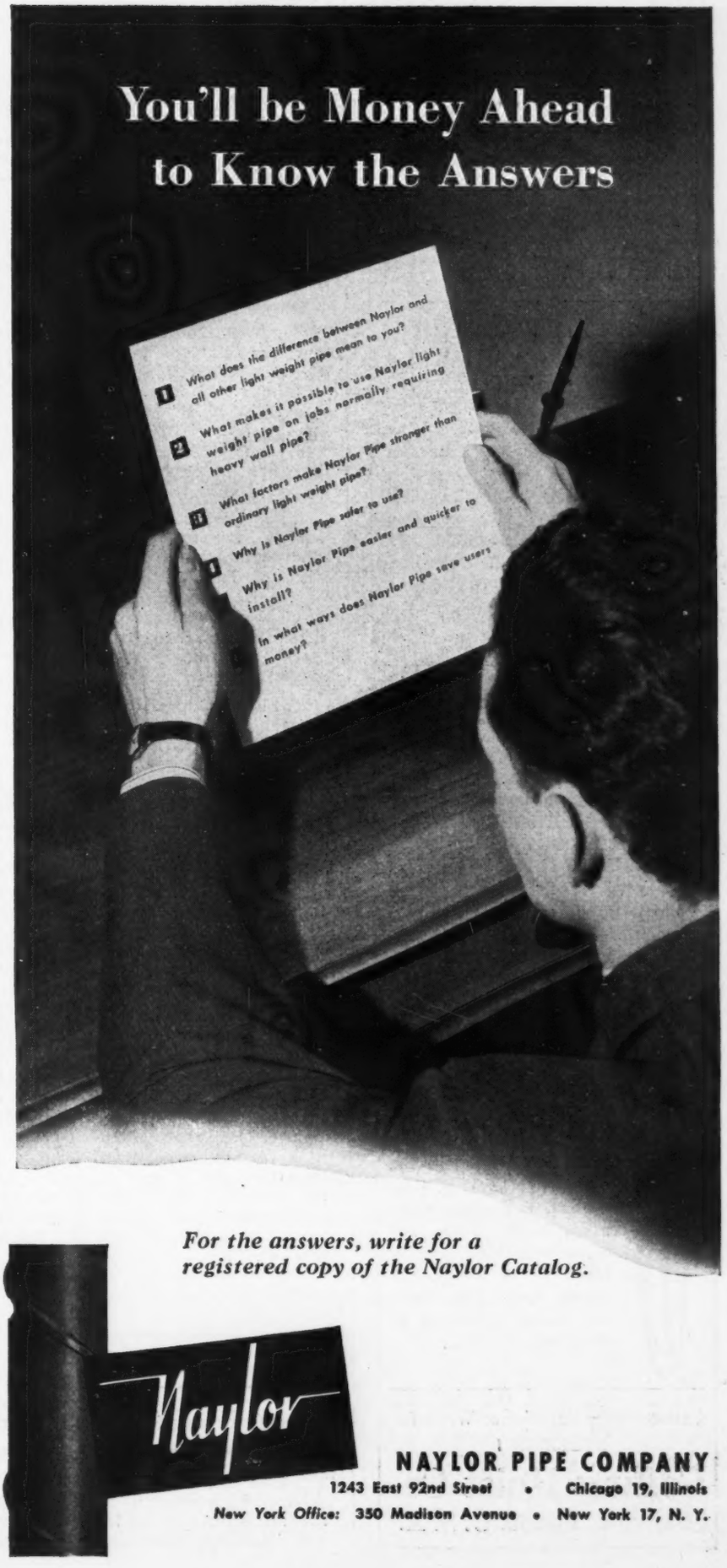
## ARIZONA

### Companies submit objections in portal suits — New orebody reported at Tennessee mine

★Arizona's copper mining men are continuing their fight against any reduction of the excise tax on copper in the reciprocal tariff treaties which will be negotiated with 18 foreign countries during world conferences planned for April. Arizona firms appearing in opposition to any cut in tariff rates are: Bagdad Copper Corporation; Castle Dome Copper Co.; Magma Copper Co.; Miami Copper Co.; Phelps Dodge Corporation; and Shattuck-Denn Mining Corporation.

★Contending that interrogatories served by the plaintiffs along with the recent portal-to-portal pay suits filed against them in the Arizona federal courts were premature and without leave of the court, three Arizona mining companies have filed objections to the interrogatories. In its objection, Miami Copper Co., contended that, in addition to being prematurely served, the information sought in the interrogatories was burdensome, over numerous, and oppressive.

The complaints filed against six mining companies seek back pay amounting to $1,697,500 for some 3,000 workers. The interrogatories requested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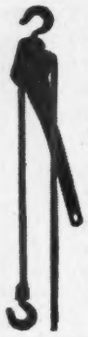

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## Arizona *(continued)*

the job titles of plaintiffs; total hours spent by workers on the premises of the defendants between punching in and punching out time each week of the year preceding the date suits were filed; the hourly rate of pay of each worker; and the amount of overtime pay received during the period.

★Fatalities in Arizona mines during 1946 numbered nine, the lowest in history, according to Clifford J. Murdock, State Mine Inspector. The number of serious accidents increased from 281 in 1945 to 323 in 1946.

★Southwestern Mines, Inc., has under lease and option to purchase the Great Western Mine, at Cortland, 30 miles north of Douglas, and work is in progress. A. H. Daugherty is general manager; D. D. Daugherty is secretary; and J. S. Coupal, of Phoenix, is consulting engineer.

★Albert Ybarra, Fred Ybarra, and William Ferguson, all of Tucson, are said to have staked a claim with gold and silver values 40 miles southwest of Tucson on the lower slope of the Baboquivari Range. The outcrop shows high-grade shipping ore after being exposed for about 10 ft. Assays running from $54 to $160 a ton are reported.

★Red Rover Copper Co., at Cavecreek, is said to have encountered ore running $50 per ton in driving a tunnel on the 900-ft. level an additional 30 ft. When the mine closed down in 1941 because of wage ligitation it was producing 200 tons of ore daily. It has only recently resumed operations.

★Great Western Exploration Co., Nye A. Wimer, president, announces plans to sink a shaft to a minimum depth of 200 ft. on the Starlight vein of the Arizona Magma mine, near Chloride. Good mineralization is being encountered at shallow depths in the shaft, which will follow the dip of the vein. The property was acquired by the company under bond and lease in 1945.

★At the Tennessee mine of the Tennessee Schuylkill Corporation, Chloride, which Wimer also heads, a new lead-zinc orebody is said to have been encountered in raising from the 1,200-ft. level to explore for the downward extension of ore previously mined out above the 900-ft. level. The ore was entered at a height of 55 ft.

Thomas L. Chapman is in charge of operations at both properties.

## CALIFORNIA

### Mineral production in 1946 had record value — Cactus Queen mine is rehabilitated

★Mineral production in California set an all-time record for value in 1946, reaching $516,685,000, in contrast to the 1945 value of $473,661,591, according to an estimate by the statistical section of the Division of Mines, as reported by W. B. Tucker, State Mineralogist. The record value was due to higher prices for crude petroleum, increased production and prices for cement, salines, and miscellaneous stone, and increased production of gold, silver, and lead. Gold output was more than twice that of 1945, with dredges contributing the major part. Estimated values and quantities for 1946 are as follows: gold, 348,000 oz.; silver, 1,368,500 oz.; copper, 6,500,000 lb.; lead, 20,130,000 lb.; zinc, 14,210,000 lb.; quicksilver, 19,000 flasks; other metals, including chromite, iron ore, manganese, molybdenum, platinum and tungsten, aggregated $2,300,000 in value. Value of the petroleum output is estimated at $367,215,000; natural gas, $33,359,000; cement, $33,708,000; miscellaneous stone, $22,500,000; brick and hollow building tile, $3,500,000; other industrial non-metallics, $12,460,000; and salines, $21,800,000.

★Leo Trucson and E. L. Anderson are conducting exploratory and development work on beryllium holdings, known as the Inyo Beryl mine, near Lone Pine, Inyo County. The property is leased from W. J. Sorensen, of Lone Pine. Minable material is found in hillside outcrops, and development consists of trenching and open-cut work. Concentrates are shipped to Eastern markets.

★Work on the property of Red Wing Mining & Milling Co., in the Rademacher district, 20 miles northeast of Randsburg, Kern County, is centered in sinking two shafts on each of two claims known as Red Wing No. 1 and Red Wing No. 2. The property was located in 1929 by Fred G. Risley, president and general manager of the company. Red Wing No. 1 shaft has reached a depth of 170 ft. and drifting is in progress to make contact estimated to be 300 ft. from the portal. At the Red Wing No. 2 shaft, now down 25 ft., a collar has been installed and hoisting equipment placed. Air-generating machinery consists of two 160-cu.ft. Rix compressors.

★Development of an orebody opened recently on the 500-ft. level in the Hasloe mine, 11 miles east of Coulterville, Mariposa County, is in progress, and Sidney and William Black, lessees, are readying the five-stamp mill for use as a pilot mill pending blocking out of sufficient tonnage to warrant installation of a new plant.

★Assessment No. 73 of 25c. a share was levied upon capital stock of Central Eureka Mining Co., operators of a gold property at Sutter Creek, Amador County, at a recent directors' meeting. This is the fifth assessment levied since September 1945, and will bring the total paid to 70c. a share. C. C. Prior, president, stated that the necessary timber for operations well into 1947 has been received, thereby

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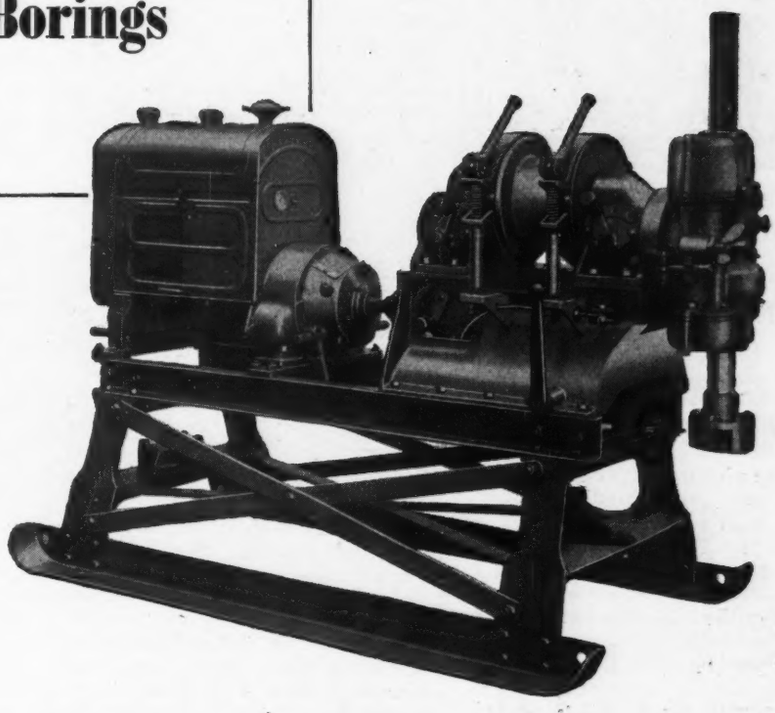

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## California (*continued*)

relieving one of the serious bottlenecks in the rehabilitation program. Purchase of this timber and of needed equipment makes the 25c. assessment necessary at this time. Dewatering of the Central Eureka shaft was started in December and is expected to be completed by early fall. Retimbering of the old Eureka shaft to the 3,500-ft. level has been completed, permitting driving of the 3,500 south drift to the Central Eureka shaft and making repairs in the north drift to the orebody,

★Yuba Consolidated Gold Fields, now operating eight dredges in different California placer fields, declared a year-end dividend of 10c. a share, payable Feb. 1. This brings dividends paid in the fiscal year ended Feb. 28, 1947, to 25c. a share. About 30,000,000 yd. of gravel were handled during the year.

★Rehabilitation work is in progress at the Cactus Queen mine, near Mojave, Kern County, with eight men employed. The mine is owned and operated by Cactus Mines Co., a subsidiary of the Mudd interests, of Los Angeles, and was the State's leading silver producer before the wartime shutdown brought about by enactment of L-208. Gold-silver ore was treated in the 125-ton cyanidation-flotation mill available at the property, and resultant concentrates were shipped to a smelter. Roy Moore is manager. The company maintains offices in the Pacific Mutual Building, Los Angeles.

★The Tropico mill, near Rosamond, Kern County, operated by Burton Brothers, is handling about 25 tons of ore a day, mined in the Tropico mine, and some 100 tons of custom ores per month shipped from neighboring mines. Clifford Burton directs operations, and 24 men are employed.

★The Surcease Mining Co., headed by Hoefling Brothers, of Sacramento, is employing some 14 men in its tungsten-gold placer operation near Atolia, in San Bernardino County. The scheelite-bearing gravel is mined by a large electric dragline and trucked to a 80-yd. per hour capacity washing plant some four miles distant. D. A. Moyer, superintendent, is in charge of operations. Allan E. Jones manages both the Atolia enterprise and the Surcease gold mine, in Butte County, where a small crew is doing underground development.

## MISSOURI

### American Metal Co. conducting seismograph survey — Research fellowships offered at Rolla

★Four diamond-drill holes have been completed by the U. S. Bureau of Mines at the Krueger property, near Potosi, in Washington County. The exploration was undertaken to determine the limits and grade of shallow deposits of lead and zinc along the Shirley fault. Neal Muir, of the Rolla office of the Bureau, is in charge of the work, which is a continuation of a preliminary churn-drilling project completed by the Bureau in 1943. No production from the property is recorded.

★A new mineral-resources map of Missouri, Nebraska, Kansas, Oklahoma, Arkansas, and Iowa has been prepared by the Mid-West Research Institute, of Kansas City, in cooperation with the geological surveys of the respective states.

★American Metal Company, Ltd., is starting a seismograph survey near Palmer, in Washington County. The purpose is to delimit the underlying Pre-Cambrian granite, which is important in localization of the lead-zinc orebodies.

★Three cars of oxide zinc ore have recently been shipped to the Henrietta, Okla., smelter from the Alice mine, in Ozark County. R. G. Doane, operator of the mine, is planning to ship at least 100,000 tons of similar material before June 30. The ore is recovered from the mine dumps and treated in log washers to raise the grade to 20% zinc before shipping. About 2½ yards of dump material is washed to produce a ton of shipping ore.

★Several research fellowships are being offered by the Missouri School of Mines and Metallurgy and the Missouri State Mining Experiment Station to graduates who have a Bachelor of Science degree, or equivalent, and have had the necessary training in mining, metallurgy, ceramics, and geology. Each fellowship carries a stipend of $675 for nine months' academic work, beginning Sept. 1, 1947. Fellows pay fees amounting to about $60 a semester. Applications will be received up to Apr. 1, and should be addressed to Dean Curtis L. Wilson at the School of Mines, Rolla. A certified transcript of college record, statement of professional experience, photograph and three letters of recommendation are required of each applicant.

## MICHIGAN

### Future of C.&H. endangered by portal suits—Geologists see hope of finding new deposits

★Groups of employees of Isle Royale Copper Co., Quincy Mining Co., Copper Range Co. and Calumet & Hecla Consolidated Copper Co. have filed suit in Federal court in Marquette, Mich., to obtain payment of $13,000,000 in back pay. Ernest Goodman and Morton A. Eden, of Detroit, are at-

torneys for the 1,355 employees named as plaintiffs in the four cases. In addition to the amounts sought for "unpaid overtime compensation," each suit seeks award of "an additional equal amount as liquidated damages, plus reasonable attorney fees and costs." Thus the suits actually call for the payment of more than $26,000,000 by the four companies.

According to Calumet & Hecla officials, if the plaintiffs are successful in their suit, the company would be forced to suspend all operations permanently. Commenting on the suit, A. H. Wohlrab, general manager, said:

"The fact that well over 25% of the Calumet & Hecla employees—patriotic and intelligent American citizens—can be beguiled into bringing a suit which, if won, would wreck the institution upon which they are dependent for their very livelihood, should, if it were not so ridiculous, be cause for serious alarm. Claims for the staggering amount of $13,000,000, if upheld by the courts, would be a most serious blow to the entire district because it would result in the suspension of Calumet & Hecla operations."

A. E. Petermann, general counsel for Calumet & Hecla, said: "The Federal District court in Detroit, in the Palmer-Bee company case, has held that an organization or a group may represent individual employees in a case of this kind, but that such organization or group must have express authority from each individual and must make each individual a party to the suit. The suit against Calumet & Hecla purports to be in behalf of all employees, but at present only 553 persons appear as plaintiffs."

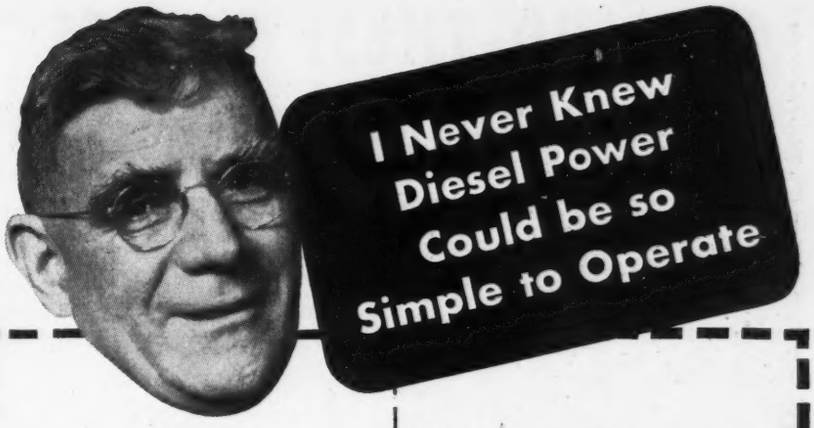
Employees of the Wolverine Tube Co., the Detroit division of Calumet & Hecla, sued for $1,000,000, but this suit subsequently was withdrawn.

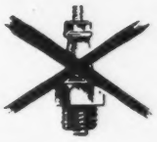
★According to Calumet & Hecla geologists, there is every reason to believe that undiscovered copper deposits remain in the Michigan district. The efforts of the company to find them have met with some success. In this connection, T. M. Broderick, in charge of the company's geological department, says:

"While there can be no positive assurance that undiscovered deposits do exist, the chances are in favor of that conclusion. The prevailing cover of glacial drift could effectively conceal such deposits.

"The tendency for conglomerate oreshoots to have short lengths along the strike near surface and the erratic distribution of copper in the amygdaloid deposits would make it possible or even likely that the widely spaced drill holes over much of the district would have failed to reveal them.

"In spite of its recognized inadequacies, diamond drilling is the best method known for the first stages of exploration in the district. It is to be credited with the discovery of the fis-

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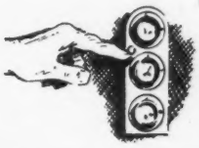

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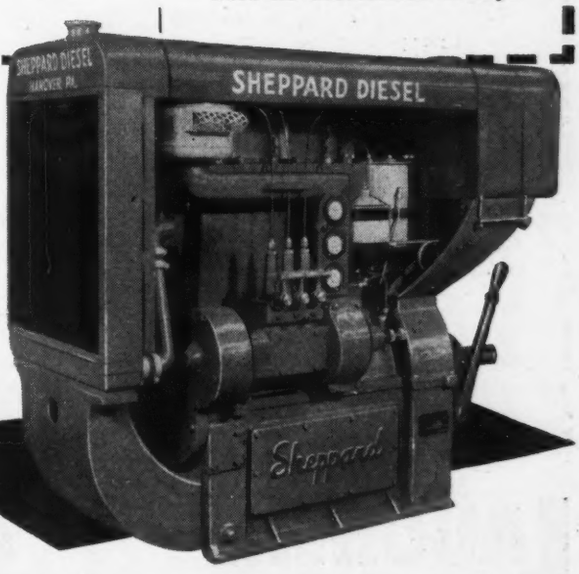


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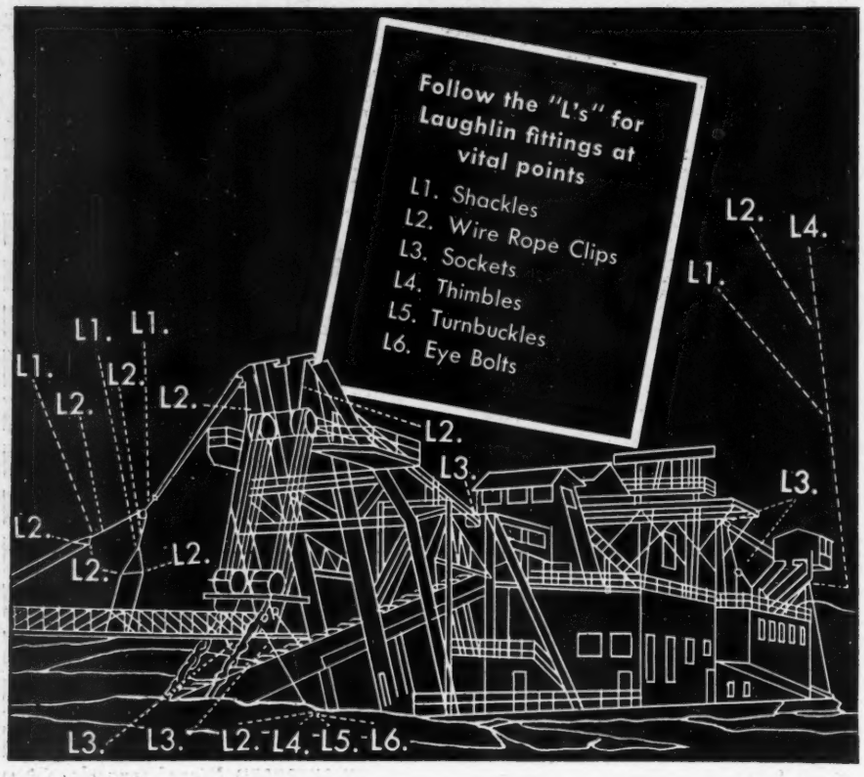


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## Michigan (*continued*)

sure mined at the Central exploration, the Iroquois amygdaloid orebody, and the Houghton conglomerate deposit at Allouez. It also served to outline the original White Pine orebody and more recently its marginal extensions to the south."

★Calumet & Hecla Consolidated Copper Co. recently purchased a 70-ton diesel locomotive, developing 660 hp., which is in service on the railroad. This new unit brings to 12 the number of locomotives in service around the mines, mills, and smelter, and is the second diesel in the fleet.

The history of the Calumet & Hecla railroad dates back 80 years when the first, narrow-gage road was built between Torch Lake and Calumet, known as the "Hecla and Torch Lake Railroad." The first locomotive was a 12-ton engine. With expansion of operations in 1906, the railroad was changed to standard gage. Today the railroad includes 14½ miles of main line and 43 miles of switching track. In addition to the 12 locomotives, the equipment includes more than 400 pieces of rolling stock.

★Not a single fatal accident was recorded during 1946 by the Calumet & Hecla working force, including both underground and surface employees. This is a new record for the company. On December 31 there were 688 men employed underground and 1,462 on surface.

## IRON COUNTRY

### Davidson iron mine taken over by Pickands, Mather — Taconite projects get under way

★The Davidson iron mine, at Iron River, Mich., was taken over on Jan. 1 by Pickands, Mather & Co., which acquired the property from Pittsburgh Coke & Chemical Co. H. J. Richards, general superintendent for Pickands, Mather on the Menominee Range, is now in charge and W. H. Looney, formerly connected with the Davidson mine, has been appointed supervisor of underground mining.

★Final disposition of the two Government ore docks at Escanaba, Mich., was made when the city's offer of $65,000 was accepted by the regional director of War Assets Administration. The docks were constructed as a wartime emergency project in 1943 to insure delivery of iron ore from the Mesabi Range if damage occurred to the Sault Ste. Marie locks.

★Experiments conducted for a year on diamond-drill blast-hole stoping at the Book mine, near Crystal Falls, Mich., have proved this system more efficient and economical than other methods used in the past. The work

was under the supervision of L. S. Chabot, Jr., underground superintendent of North Range Mining Co., who presented a detailed report at the Minnesota sectional meeting of the A.I.M.E. in Duluth on Jan. 13.

★Reserve Mining Co., in connection with plans projected for extensive development of taconites near Babbitt, Minn., on the eastern Mesabi Range, has filed application with State and Federal agencies to construct a dock, harbor, and breakwater northeast of Beaver Bay as an outlet for the taconite concentrate. Frank J. Smith, of Ramsay, Mich., range manager of the firm, said his company was also seeking permission to use lake water in beneficiation of the low-grade ore. The company, which is a subsidiary of Oglebay Norton Co., Cleveland, Ohio, acquired property in the Beaver Bay area last fall and also considerable holdings at Babbitt for a townsite. The project is one of three proposed for concentrating iron ore from taconite. Pickands, Mather & Co. recently announced construction of a plant, starting about July 1, involving the total expenditure of approximately $1,500,000, and Oliver Iron Mining Co. has also revealed that it intends to start work this year on two iron-ore beneficiation plants at a cost of $2,000,000 or more.

★Pickands, Mather & Co. is installing two conveyor-belt systems on the Mesabi Range, one at the Embarrass mine, at Biwabik, and the other at the Scranton mine, at Hibbing. At the latter operation a 30x42 jaw crusher with feeder and screen equipment is being installed. From this plant a 30-in. conveyor belt, 1,600 ft. long, will elevate the crushed ore 350 ft. to the shipping pocket on the surface. Crude ore will be hauled to the crushing plant in the pit by trucks. The installation will be completed during the 1947 shipping season.

## ALABAMA

### Early production foreseen at Etowah's red-ore mine

★Etowah Coal & Iron Co., at Gadsden, expects to be in full production at an early date. The company has taken over the former Japanese Government mine and installed equipment for planned output of 1,000 tons of red ore a day. R. L. Bains, general manager, said that the mine will be one of the most modern in Alabama when present work is completed. It will be completely electrified. Installation of a separator, crusher, and conveyor system is now in progress. A Sullivan 1,636 cfm. compressor is in operation. The mine has been pumped dry and provisions have been made for seepage to flow to a sump where an automatic pump will lift the water to outside level. Tests on ore at the


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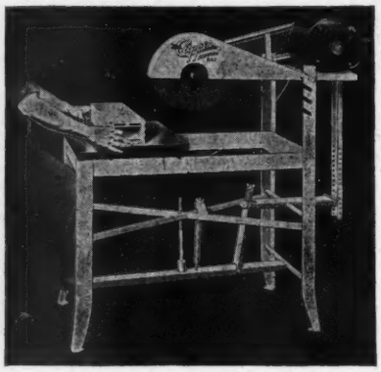

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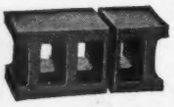
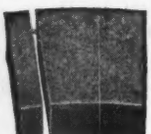


**This concrete block, converted into a special size, was cut completely in two in 19 seconds.**

**One of the many intricate cuts performed on first quality clay brick for heat treating furnaces —made in 8 sec.**



**Rotary Kiln Blocks, cut to size for "key" bricks in rotary kilns, require only 10 sec. for completion of cut.**

**Basic refractories for steel furnaces or cement kilns must be accurately installed. This magnesite brick was cut in 12 seconds!**

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## Alabama *(continued)*

600-ft. level show 41 to 48% iron and some tests run higher.

★Sloss-Sheffield Steel & Iron Co., at Birmingham, is operating at full capacity and expects to maintain the present rate for some time. Construction of the heavy-media separation plant at Russellville is now about 60% complete. It is anticipated that operations can be started in the spring. Material-handling and other equipment are now being installed.

## GEORGIA

### Kaolin industry seeks increase in tariff—County by county survey of minerals under way

★Heavy rains during January interfered with clay mining in Georgia, causing many companies to shut down. Clearer weather has since enabled resumption of operations. Washington County now has more operating companies and more extensive deposits than any other county in the State. The tonnage to be shipped this year is expected to exceed all previous records.

★Representatives of Georgia's kaolin industry have launched a move to obtain an increase of 75c. a ton in the import tariff. The present tariff is $1.75 per ton. Charles J. Bloch and John B. Harris, Macon attorneys, appearing before the State Department's Committee on Reciprocity Information, in Washington, pointed out that under a 1930 act the tariff was set at $2.50 a ton and remained at that figure until January 1939, when it was cut back to $1.75. More than 75% of the kaolin produced in the United States is mined in Georgia.

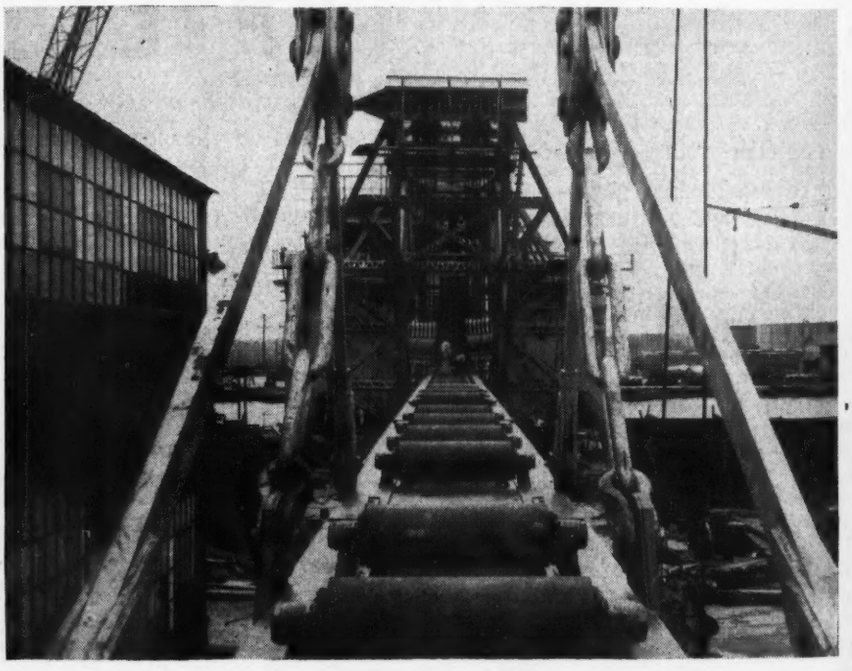
★A comprehensive survey of the geology and mineral resources of all counties in Georgia is being undertaken by the State Department of Mines, Mining, and Geology, according to Captain Garland Peyton, director, who explained that the survey, in which the Tennessee Valley Authority is participating, will cover the northern section of the State first. County reports will be published which will include a geologic map, description of the geology of the county, and the results of investigations of mineral resources.

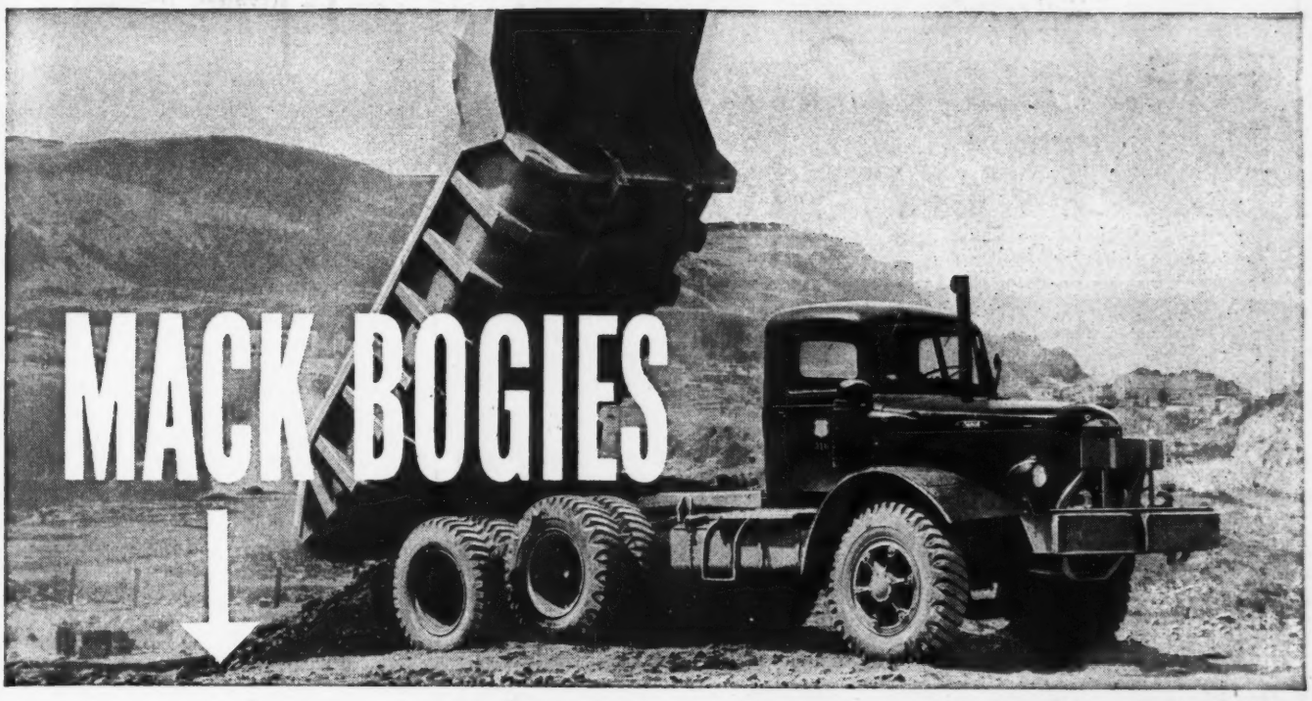
## ALASKA

### Gold production in 1946 shows big increase—Urge extension of assessment work exemption

★Gold production in Alaska in 1946 rose to almost three times that of 1945, but the production of non-metallic minerals was 85% less, according to the U. S. Bureau of Mines. Total value of mineral production was $11,108,000, a 9% increase over the figures for 1945. Gold production was 192,527 oz., valued at $6,738,445, compared with 68,117 oz. valued at

**THE LARGEST DIGGING LADDER ever constructed in the United States is being installed on the dredge "Stuyvesant", under construction at the Tampa, Fla., yards of Tampa Shipbuilding Co. for the Billiton Company, of The Hague, Holland. The 215-ft. long ladder contains a chain of 145 buckets holding 1 ton each. The equipment is for use in tin dredging in the Dutch East Indies, where it will be towed via the Panama Canal.**



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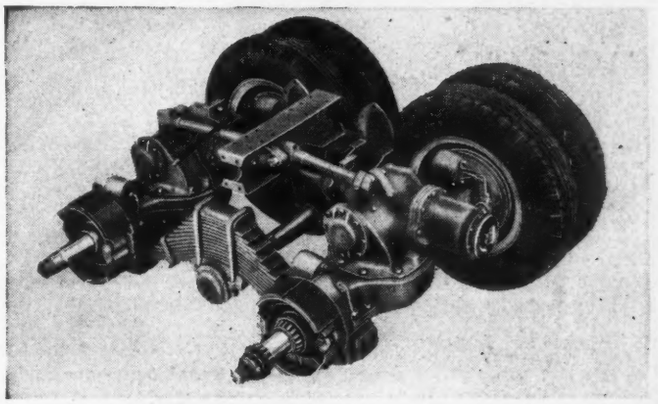
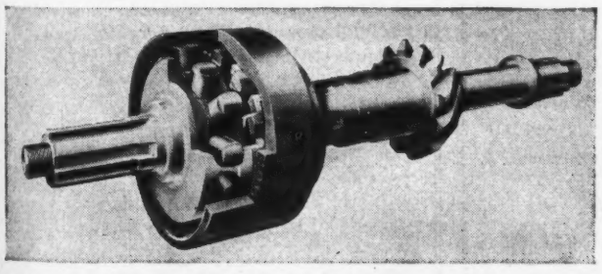
Furthermore, it's not added weight or complicated parts that give these advantages . . . it's perfected balancing. The Mack bogie is actually simplified and lightened.

Most important among its many features are two Mack exclusives: One, the Mack Power Divider, preserves traction on slippery ground without overstress on any part, and prevents wheel fight and tire wear. The other, Mack rubber Shock Insulators, makes twisting of the springs impossible even over roughest roads.

The Mack bogie is only one of the reasons Mack 6-wheelers are preferred where the hauls are tough.



**THE MACK BOGIE** is rugged, yet unusually simple and accessible. Perfected balancing makes bogie hopping, wheel fight and tire scuffing unknown.



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## Alaska (*continued*)

$2,384,095, in 1945. Silver production was 29,058 oz., valued at $23,479 compared with 9,983 oz., valued at $7,099, the previous year. Mercury production was less than in 1945, and platinum declined about 13%. Other nonmetals were valued at $684,000, compared with $4,573,000 in 1945. Among placer producers were the United States Smelting, Refining & Mining Co., in the Fairbanks area; Alluvial Golds, Inc., on Woodchopper Creek, and Gold Placers, Inc., on Coal Creek, in the Circle area; Wade Creek Dredging Co., in Fortymile area; Arctic Circle Exploration, Inc., in the Fairhaven area; Caribou Mines, in the Kantishna area; Bristol Bay Mining Co., in Goodnews Bay area; New York Alaska Gold Dredging Co., in the Tuluksak-Aniak area; Brinker-Johnson Co., in the Fairbanks area; and C. J. Berry Dredging Co., in the Circle area. Lode operators were Cleary Hill Mines, Inc., in the Fairbanks area, and Gold Cord Mining Co., in the Willow Creek area.

★A thorough geological search is being made by the Interior Department to find out if the Territory is a source of uranium. Fifty-six geologists covered a wide range of field study last summer, and analyses at laboratories are continuing through the winter.

★B. D. Stewart, Territorial Commissioner of Mines, is favorably impressed by samples of limestone, gypsum, and clay submitted by prospectors from the Railroad belt. Materials are needed for the Territory's industrial development, Stewart says. Special study of the limestone of the Ketchikan area is being made. Aluminum Company of America hopes to ship 500,000 tons annually from limestone deposits at Edna Bay, 100 mi. from Ketchikan, to its aluminum plant at Vancouver, Wash., and other northwest ports.

★W. S. Pekovich, of Juneau, with other associates, has optioned the Unga mines, consisting of gold, silver, lead, copper, and zinc lodes, on Unga Island, in the Shunagin group, in southwestern Alaska, from L. C. Green, of San Francisco. The deal involves $250,000 to be paid at intervals up to Jan. 1, 1955. Mining was done in this area around the turn of the century. Gold was the principal production. With higher prices for metals and modern mining methods, Pekovich hopes to make the other minerals pay also.

★Pacific Alaska Mining Co.'s Independence gold quartz mine, in the Willow Creek area, employing about 40 men, ceased operations in January but plans to begin work again in the spring. It is the largest gold-quartz mine operating in the Territory since Alaska Juneau closed.

★Alaska Miners' Association has asked Delegate E. L. Bartlett to re-

quest a year's extension of the exemption from $100 assessment work on mining claims. The Association has asked the cooperation of the American Mining Congress. The request was made because of acute labor and supply shortages.

★Leo Saarela, of the mining department of the University of Alaska, offered a four-week course for miners at Ketchikan, starting Jan. 20. Lectures on geology, ore deposits, lode and placer mining, prospecting and sampling, were supplemented with laboratory work consisting of mineral determination. A placer-mining short course was also held at Fairbanks High School, in January. Larry Doheny, Bruce Thomas, of the Territorial Department of Mines, and Douglas Colp, a mining engineer, were instructors.

## CANADA

### Noranda strike over — Higher-grade ore at Lynn Lake—B. C. mines getting back to normal

★The 80-day-old strike at Noranda Mines, Ltd., was brought to an end at midnight on Feb. 10, following a week of mediatory effort by Justice Oscar L. Boulanger, who was appointed as an Industrial Disputes Inquiry Commissioner by the Minister of Labor at Ottawa. A breakdown of negotiations had taken place at Ottawa on Jan. 21. After acceptance by the union of the company's offer of a 13c. an hour wage increase, H. L. Roscoe, Noranda vice president and general manager, stated: "Now let's forget the past and get back to work." In lieu of the checkoff the union accepted the proposal that union representatives should have facilities to interview new employees when they report to the plant dispensary for physical examination. A major point at issue in the strike was Noranda's refusal to collect union dues from wages.

★The Canadian price of electrolytic copper was advanced to 16.625c. by the Wartime Prices and Trade Board in January. The effect of this 5c. price boost at the Noranda mine was expected to increase 1947 revenue by something over $500,000. Previous to settlement of the strike, James Y. Murdoch, Noranda president, had stated that an increase of 10c. an hour in the wage rate would add more than $400,000 a year to operating costs.

★Since the summer of 1945 Canada has reestablished about 750,000 veterans and 500,000 war workers in peacetime operations. The mining industry had taken 5,700 of these men up to November 1946. The wage payroll index (1937 = 100) of the Canadian Bank of Commerce shows


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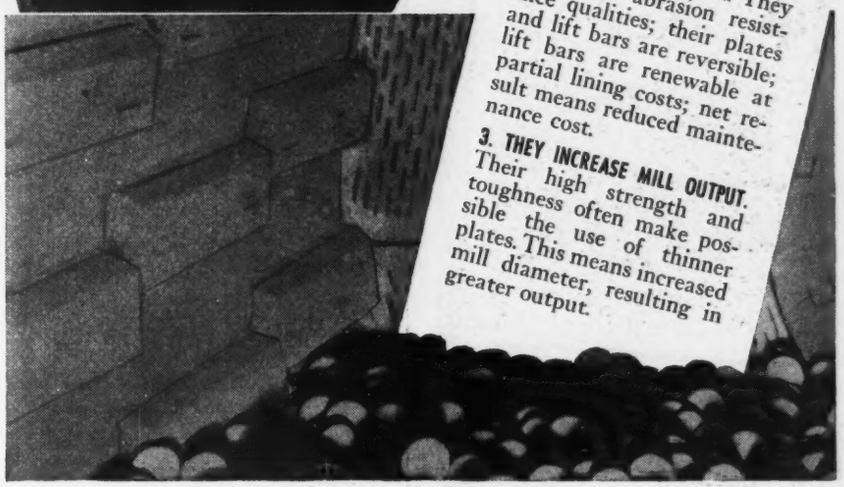

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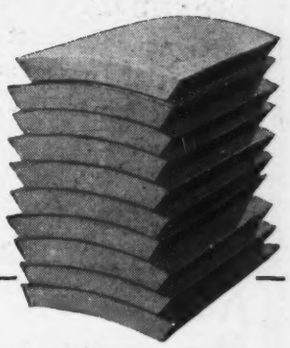

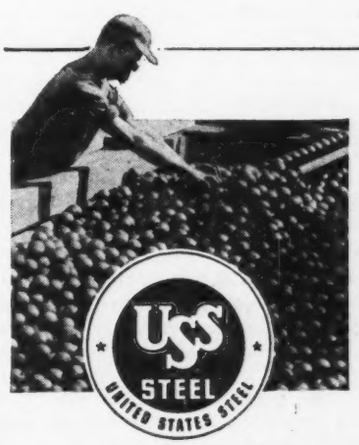


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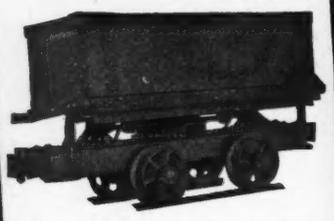

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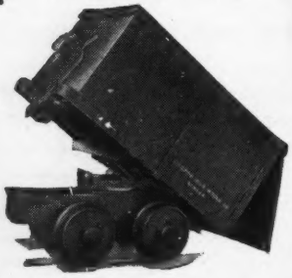

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## Canada (*continued*)

that mining advanced from 93, in October 1945, to 107 a year later. The Dominion Bureau of Statistics reported the average hours and average weekly earnings as follows: On Nov. 1, 1946, workers producing metallic ores averaged 45.3 hours per week, compared with 46.4 for the same week in 1945; average weekly wages advanced from $39.39 to $40.50 in the same period, based on records for 29,174.

### QUEBEC

★Aluminum Co. of Canada, one of 40 companies in various parts of the world controlled by Aluminium Ltd., reports production at the Arvida plant at about 40 percent of the 1943 wartime peak, or 200,000 tons of ingot annually. Smelting units at Arvida comprise 14 pot rooms each having 72 pots. Business in 1945 was about $113,000,000 compared with the 1943 record of $290,000,000. It is stated that domestic consumption of aluminum metal is now about 15,000 tons a year. In November 1946 exports amounted to 48,000 short tons. All bauxite processed at Arvida is imported from the very extensive deposits in British Guiana. Greenland is the source of cryolite, which is supplemented by about 10% of synthetic material.

★Mistassini Explorations, Ltd., as stated in these columns in December, was successful during the 1946 field season in locating deposits of magnetite and high-grade lead ore, the latter having been traced at intervals for a reported length of 3.5 miles, and protected by a group of more than 200 claims. Additional staking completed in January included two groups of claims to cover the outcrops of high-grade magnetite and copper-nickel-bearing norite. Plans announced for the coming field season provide for diamond drilling on the lead deposits and aerial reconnaissance to guide additional exploration and prospecting. Inspiration Mining & Development Co., Ltd., and several other companies are associated in this program, including Dome, Sullivan, Molybdenite Corporation, and Leitch Gold Mines.

★Dr. J. E. Gill, consulting geologist, has recommended that Croinor Pershing Mines deepen the shaft and open two new levels at its property in Pershing Township. Oreshoots of medium grade and large size have been indicated. Since starting work in 1944 Croinor has carried on extensive exploratory work, and additional diamond drilling is now planned. Underground work is being centered on drifting to the east under surface trenches which show substantial gold values.

★Duquesne Mining Co., Destor Township, is concentrating underground work and diamond-drill tests in an effort to interpret the complex pattern of the erratic ore occurrences. Alternating sections of high-grade and low values have made it difficult to determine the most efficient method for mining the gold deposit indicated by more than ten years of exploratory work. C. Glenn Hunter, president, reports that increased capitalization will be required to finance the mine to production. D. H. Angus is mine manager and A. C. Lee is consulting engineer.

### ONTARIO

★W. Maybank, president of Maylac Gold Mines, reports that the former Hutchison Lake Gold Mines property, in the Little Long Lac area, will deepen the shaft from 250 to 500 ft. The two new levels to be established are stated to be justified by the discovery of high-grade ore in the old workings on the first level. Coarse visible gold was exposed in the east drift in taking down the backs and in systematic back sampling near the stope where the test shipment of 763 tons of ore for the Hard Rock mill was secured. The shipment showed an average grade of $25 in gold per ton. Additional ore shipments are to start next spring. M. R. Brown is engineer in charge.

★Kirkland Golden Gate Mines, which shut down several years ago, started milling ore in February. The reorganized Kirkland Gateway company now plans to operate at a daily rate of about 60 tons, recovering known ore grading about $10 a ton. After deepening the Crescent shaft from 400 to 670 ft. it is planned to increase output of the mill, which is rated at 150 tons daily. It is also planned to reopen the main shaft if favorable results are secured from the exploratory work now in progress.

### MANITOBA

★A preliminary estimate of the mineral production of Canada for 1946, released by the Dominion Bureau of Statistics, indicates the value of both metals and industrial minerals produced in Manitoba will exceed that of the previous year. Metallic production is estimated at $11,403,577, compared with $10,423,066 in 1945. Estimated non-metallic production is $5,272,699, compared with $4,006,357 in 1945. The following are the details of production with the corresponding figures for 1945 in parenthesis: gold, 78,732 (70,655) oz. valued at $2,893,401 ($2,720,218); silver, 530,000 (533,883) oz. valued at $443,345 ($250,925); copper, 40,000,000 lb. (41,126,155) valued at $5,120,000 ($5,161,332); zinc, 36,010,819 lb. (34,860,754) valued at $2,812,445 ($2,245,033); cadmium, 61,000 lb. (27,891) valued at $74,420 ($27,612); selenium, 34,000 lb. (9,258) valued at $54,300 ($17,775); tellurium, 4,333 lb. (89) valued at $5,666 ($171);

gypsum, 64,300 tons (42,275) valued at $437,700 ($300,636).

★Diamond drilling on a new anomaly to be known as the "L," Sherritt Gordon Mines, Ltd., has obtained a high-grade nickel intersection located some two and one-quarter miles southeast of the "A" anomaly at Lynn Lake. In contrast to all previously located occurrences, which are of the disseminated type, the new discovery is composed of massive sulphides. The first drill hole reached the sulphides after passing through 37 ft. of overburden. At 442 ft. the hole was still in sulphides, and the first 334 ft. averaged 4.72% nickel and 1.58% copper. The size and dimensions of the new body are not known, but the magnetometer survey indicated an anomaly having a minimum length of 300 ft. The "L" anomaly is 1,500 ft. west of the boundary between groups owned by Sherritt Gordon and God's Lake Gold Mines, Ltd.

★During 1946 some 3,300 mining claims were recorded in the Province, approximately two-thirds of which have been staked in The Pas mining district. A large part of this staking is the result of interest in the nickel-copper discoveries in the Granville Lake mining division.

★In reviewing the work accomplished at Ogama-Rockland Gold Mines, Ltd., in the vicinity of Long Lake, officials draw attention to the fact that the high-grade material on the 250 and 375-ft. levels, where drifting is under way, is across widths of from 7 to 15 in. Work on the 110 ft. level, from which a high-grade lens was mined previously, is being resumed, following which development on all three levels will be pushed simultaneously. Later the shaft will be deepened to open three additional horizons. Plans for the mill are being held in abeyance until conditions are known on all six levels. Gunnar Gold Mines, Ltd., with a major interest in the property, recently advanced $250,000.

## BRITISH COLUMBIA

★Amendments to the Mineral Act and Placer Mining Act, to include in future the cost of geological or geophysical surveys or examinations, by or under the supervision of registered professional engineers, as part of the minimum requirements in assessment work to be undertaken annually, have been approved by the British Columbia Government. Holders of mineral claims are required to effect assessment work to a value of $100 per claim annually.

★Big Four Silver Mines, Ltd., in the Portland Canal district, is concentrating on an intensive underground development program with a view to intersecting at depth extensions of veins indicated by surface exploration. Recession of the Silverado glacier during recent years has exposed seven new ore-shoots on the

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## Canada *(continued)*

Nos. 2, 1, and 4 veins, in addition to a wide, well-mineralized area from which a grab sample assayed 0.02 oz. gold, 14.6 oz. silver, and 14.5% lead.

★Privateer Mine, Ltd., in the Alberni mining division, produced gold valued at $31,156 during December last. Operating profit was $5,871 before provision for depreciation and depletion. Installation of a new compressor early in February is expected to permit a material increase in the amount of ore mined and treated.

★Shareholders of Twin "J" Mines, Ltd., have approved an increase in the company's capital structure by the issue of 500,000 additional shares of a par value of one dollar each. Funds accruing from sale of the new stock will be used on mine development, which will not be charged against production, scheduled to start March 1 at 150 tons daily. P. E. Peterson, mine manager, has estimated ore reserves at 68,000 tons, sufficient to operate the mill for a year and a half. The proven ore zone has a length of 2,200 ft., and contains two orebodies, parallel to each other and about 150 ft. apart.

★Britannia Mining & Smelting Co., Ltd., Howe Sound subsidiary, has increased the milling rate at the Britannia mine, Vancouver mining division, to 3,000 tons daily. Work was resumed in November at the termination of the miners' strike. More than 700 men are now on the payroll. Company officials estimate 900 as the number essential to bring the operation to projected capacity.

★Improvement in the labor supply has permitted Bralorne Mines, Ltd., to increase milling rate to 350 tons daily, after running at approximately 200 tons during December. More than 300 men are now at work, with 450 estimated as the minimum required for capacity production. Pioneer Gold Mines of B. C., Ltd., also in the Bridge River district, resumed milling Jan. 28 at 100 tons daily.

★Hedley Mascot Gold Mines, Ltd., in the Osoyoos district, will resume milling late this spring, when ore will be drawn from both the Mascot fraction and the Good Hope claims. The company has received $170,000 from the shipment of 1,352 tons of concentrate since settlement of the strike of the International Union of Mine, Mill and Smelter Workers.

★Brooklyn-Stemwinder Gold Mines, Ltd., reports encouraging ore intersections in its diamond-drilling program at properties in the Greenwood mining division. Drilling in one hole was suspended as a result of caving after cutting 4 ft. assaying 0.35 oz. gold and 4.0% copper, with the bit still in ore. Another intersection gave 2.5 ft. of ore assaying 0.3 oz. gold and 7.7 percent copper per ton.

★The Emerald tungsten mine, expropriated by the Dominion Government in 1942 from Iron Mountain, Ltd., a San Francisco company, has been purchased from War Assets Corporation by Canadian Exploration, Ltd., a subsidiary of Placer Development, Ltd. The property consists of 41 claims at an elevation of 4,000 ft. on the east bank of the Salmon River, in the Nelson mining division. The original claims were staked in 1904, and during its early development the property shipped a considerable quantity of high-grade ore. When Wartime Metals Corporation took charge in 1942, the property was hastily prepared for production and a 300-ton mill was erected in the river valley and connected with the mine by 6,000 ft. of aerial tramway. It operated for a brief period in the fall of 1943, but was closed when the demand for tungsten materially lessened. At that time, E. E. Mason, engineer in charge, stated that two years' ore supply is assured at a milling rate of 300 tons per day, with good possibilities of developing additional ore.

### YUKON

★Yukon Consolidated Gold Corporation, Ltd., recovered gold in 1946 valued at approximately $1,400,000. Six of the company's nine dredges were operated. Provisional figures for the year show a profit of $335,000 before provision of $265,000 for depreciation or allowance for taxes. Directors have authorized payment of a dividend of 6c. per share March 7. Disbursement, which has not been earned during the years 1944, 1945, and 1946, will be made from accumulated surplus, which at Dec. 31, 1945, stood at $1,538,486. C. E. McLeod, secretary, stated, in part:

"No prediction can be made at this date as to what supply of labor may be expected for the season of 1947. A great deal depends on securing adequate labor to increase the scale of operations, requiring about 700 men at full capacity, as well as on the factor of costs, which are certain to be increased because of higher wages and the high cost of all materials used."

★"Mining in the Yukon has not looked so bright for years," said George Black, Member of Parliament from Yukon Territory, in Seattle, Wash., in January. He said he was going to exert every effort to get the Canadian Government to grant money to put the road from Mayo, on Stewart River, to Minto, on the Yukon, in condition for freighting to and from the mines. He pointed out that a modern system of roads should join Whitehorse, Mayo, Dawson, and the Carmacks district, where new gold lode mining is in progress. "The Yukon Consolidated Gold Corporation, operating dredges on some creeks now being mined for the third time, has plans for profitable production for 20 years even if new finds are not made," Mr. Black said. "Two lode gold discoveries in the Carmacks district will be producing this year. Another on Log Jam Creek is being developed by Hudson Bay Mining & Smelting Co., and this year Ed Barker will be producing placer gold west of Whitehorse. A shipment has been made from prospecting on the lode gold deposits in the Klondike area at the summit of the divide which may prove worth while." He also mentioned Keno Hill Mining Co., and Yukon Northwest Exploration Co., working silver-lead properties, both of which are preparing to operate on a large scale.

## MEXICO

### Silver price drop has mining circles worried — Freight rate increases also troublesome

★Silver is again, and more sharply, in the spotlight in mining. The drop in the price of silver and keener competition on world markets are definitely giving producers and mining labor much concern, an anxiety that several business and financial circles share because a depression has started in Mexico. Merchants and industrialists say their sales are 30% below last winter's levels. But "El Nacional," the Mexico City daily that is the Government's organ, avers that the fall in the price of silver is unimportant and it finds financial circles annoyed at "alarmist versions" that are circulating about cheaper silver. The paper said that in 1945 silver amounted to only 4.4% of Mexico's exports, while last year it was 4.9%, and during the first 11 months of 1946, when the silver price was high, Mexico's white metal exports totaled 125,000,000 pesos, while that of industrials was worth 270,000,000 pesos ($55,253,000).

The Confederation of Chambers of Commerce estimates that cheaper silver and the hoof and mouth epidemic will cost Mexico at least 100,000,000 pesos. The Labor Ministry (Lic. Andres Serra Rojas, Secretary) admits that it is striving to settle the case of the Cia. Minera de Real del Monte y Pachuca, Pachuca, Hidalgo, stating that because of the lower price of silver it cannot obey the ruling rendered by ex-President Manuel Avila Camacho, when the price jumped to 90.05c., that the resulting profit between that level and the 71.111c. rate must be shared by a third with labor.

★Government circles say the Federal Government and the major mining companies are making a series of technical arrangements that are de-

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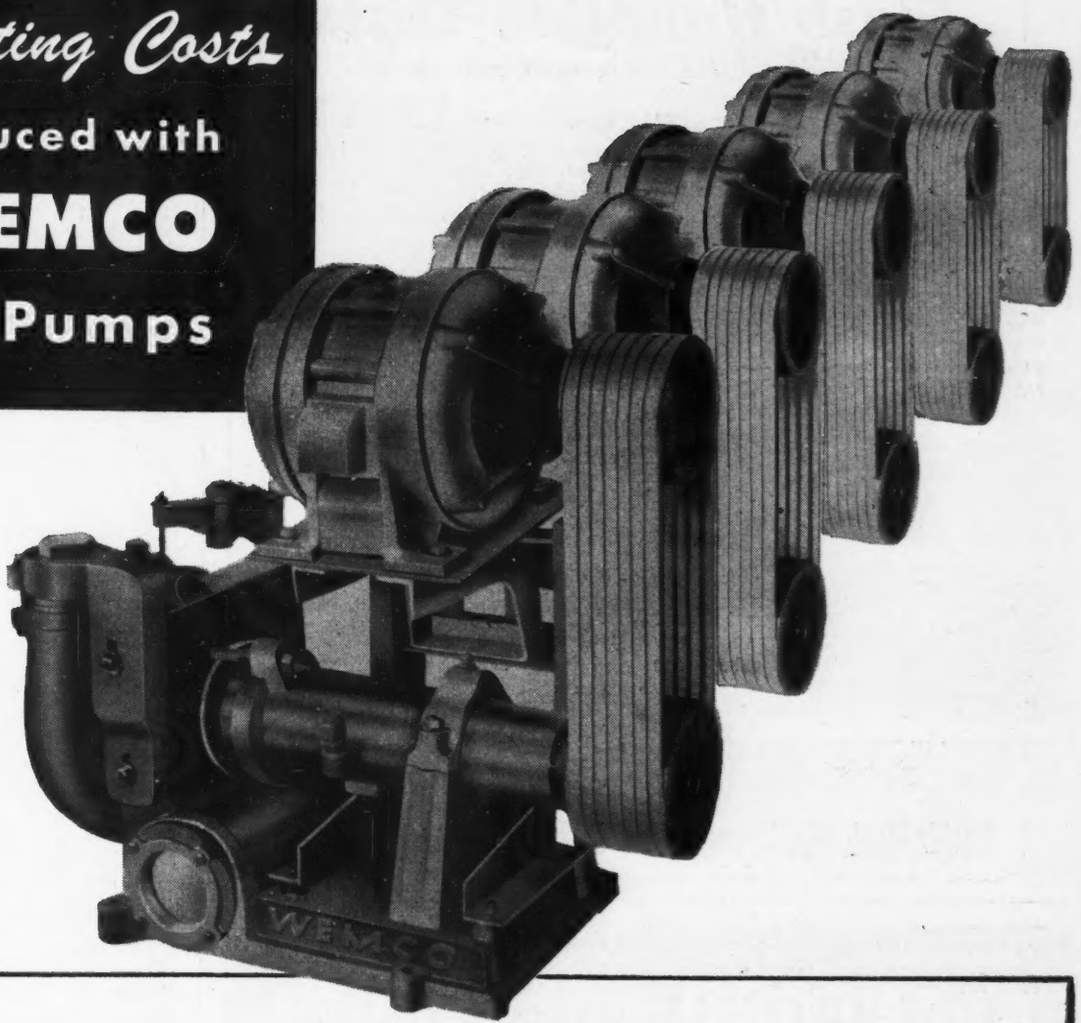


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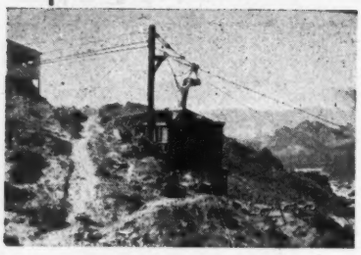

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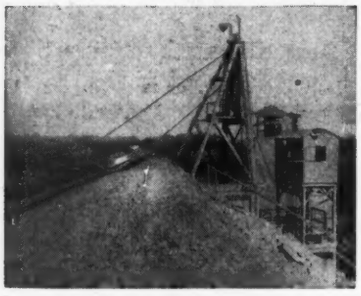

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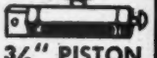

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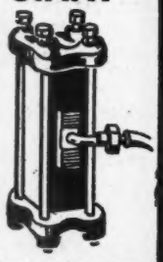

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## Mexico *(continued)*

signed to enable mining and Mexico to face conditions that can harm national economy and could, it is feared, stop 50 to 60% of mining and plant works in this country. These arrangements are being made privately, it is explained, between high Government officials and representatives of the great mining companies. The silver price and more sellers of the metal on world markets are said to be the two greatest problems currently confronting mining and Mexico in her relation to mining.

★Mining sees as a considerable obstacle the presidential authorization for the railroads to raise their freight rates. This increase is an average one of 38% for metals and minerals. Rail labor had long been clamoring for the general increase, and particularly for the one for mining products. It is estimated that the new tariffs will raise the railroads' annual revenues by 13,000,000 pesos, of which metals and minerals will contribute 5,000,000. Prime necessity items are exempt from this increase, which small and medium scale mining operators aver is a grave danger to them, because they function on but a small margin. Though effects of this boost are not yet felt, difficulties stemming from it are feared for the near future. Even a large element of mining labor is shaking its head at the hike and criticizing radical sectors of labor for bringing about what they consider will be most detrimental to mining, and indirectly to Mexican economy.

★The Cia. Metalurgica Anita, S. A., Guanacevi, Durango, is threatened with a strike by its employees, members of Section 37 of the national miners union, unless it grants them each a daily pay increase of 1.50 pesos (32c.). The workers told the Labor Ministry that the company can well afford to grant the raise as its annual income has increased to 715,576.08 pesos from 526,259.96 pesos. The company, contending that it cannot grant the increases, told the Ministry that the income the workers cited is gross, not net, which it contends is very small.

★Tampico is fast coming back as a leading port for the export of metals and minerals after wartime dormancy. Reports from the port say 50,000 tons of lead are there awaiting shipment to the U. S., Holland, Belgium, and Argentina. This will be Mexico's largest postwar export of lead. Government sources say Mexico's export of lead and some other metals to Europe has been intensified of late. Belgium, particularly, promises to become a surprisingly important customer for Mexican lead.

★Plans are being completed for the establishment in the near future of several more small metal treatment plants at strategic points in the mining zones for the prime service of

small- and medium-scale operators and prospectors, it is learned at the Commission for the Stimulation of the Mining Industry, which functions under the jurisdiction of the Ministry of National Economy, Antonio Ruiz Galindo, Secretary.

## CHILE

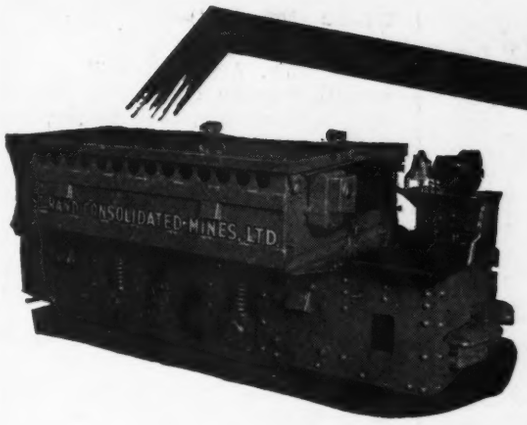
### Braden working again as arbitration ends strike — Chilean Argentine pact details given

★Messrs. Fontaine and del Puerto, with financial help from the Corporacion de Fomento, have been developing a lead-zinc mine at Batuco, near Santiago. The ore occurs in well-defined veins in porphyry; sequence of deposition was chalcopyrite, blende, and galena. The Corporacion has been assisting in development of zinc mines wherever possible, with the idea of one day setting up an electrolytic zinc plant in Chile.

★Cia. Minera de Tocopilla, a medium-sized copper producer with mines and mills at Tocopilla and Ovalle, continued operations after Metals Reserve Co. stopped buying copper concentrates in Chile at the end of the war. These operations were financed by the Caja de Credito Minero, and the copper concentrates produced were stockpiled at Tocopilla. Recently the company sold its stock of 7,000 tons of copper concentrate to South American Metal Co. at a handsome profit, for which the high price of copper is responsible.

★Among resolutions passed at the congress of mining men held in Santiago in January were those calling for: a Government-operated copper smelter at Paipote and a refinery and fabricating plant at the port of San Antonio; lead flotation sections at Government-operated mills and a lead smelter when enough concentrate is accumulated; resumption of silver coinage in Chile.

★The commercial agreement signed by Argentina and Chile provides, among other things, for a credit to Chile of $25,000,000 from Argentina, of which half can be used in 1947 and half in 1948. Interest on the loan will be 2½% per year. A Chilean-Argentine Corporation will be formed, to the capital of which Argentina will contribute $75,000,000, interest on which will run to 4% per year. The board of directors of the new corporation will include three Argentines and four Chileans, one of whom will be the president of Chile. This company will be aimed at developing Chilean industries. Still a third loan of $75,000,000 will be used to help develop Chilean public works, the nature of which will be determined by the unanimous vote of a committee of three Argentines and three Chileans. In return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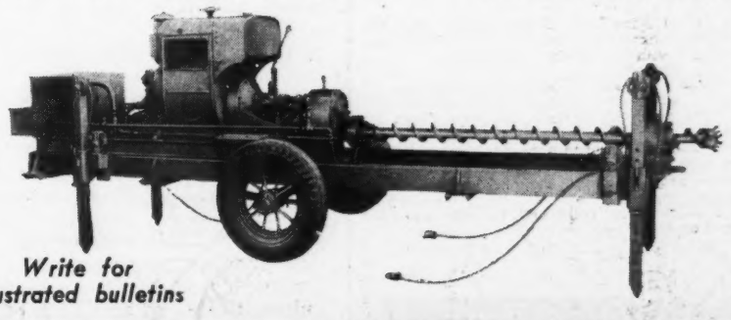

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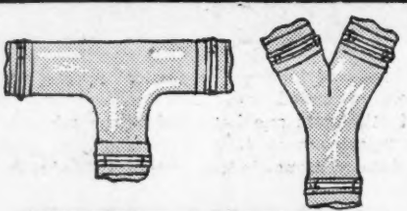

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## Chile *(continued)*

for all this, Argentina will get increased supplies of Chilean copper, iron, steel, nitrate, coal, timber, and electric power.

★Cia. Minera Disputada de los Condes is preparing to start its mine and mill, which have been shut down for the past year and a half. The mine is at an elevation of 13,000 ft., from which a ropeway leads down to the 500-ton mill. A second ropeway, 16 miles long, leads from the mill almost down to Santiago.

★Considerable interest has been shown lately in Santiago mining circles in a new oxidized copper deposit called Huiquintipa, located in the Antofagasta province northwest of the old copper mines of Collashuasi. The deposit is said to contain more than 10,000,000 tons of 3% ore. Altitude there is about 16,000 ft. Canadian mining interests are reported examining it.

★The rise in the price of silver has increased activity in the silver-gold camp of Lomas Bayas, southeast of Copiapo. So far only dumps are being worked, the hand-sorted ore being trucked down to the Caja de Credito Minero's Bordos mill. Grade of ore milled is about 10 oz. silver and 0.1 oz. gold per ton.

★Chile, Andes, and Braden copper companies are working at capacity again. Braden, resuming work after a three months' strike, is milling up to 28,000 metric tons of ore per day, but this tonnage will probably have to be reduced after February because of lack of water for milling. The last two years have been among the dryest on record, and not enough snow has accumulated in the Andes to maintain water supplies all the year.

★Rosario de Andacollo, a gold company with a 300-ton flotation mill, has been working at less than half capacity for over a year because of reduced tonnage of high-grade ore. The company has reserves of millions of tons of ore running less than 0.1 oz. gold, but lacks funds to develop reserves above the critical grade.

★Sr. Franklin Quezada, judge of the Santiago Court of Appeals, was nominated as the arbiter in the Braden copper strike. The decision by which the strike was settled included: a 15-peso wage increase, effective Aug. 16, 1946, which represents $0.78 daily to the company and $0.48 to the men, because of the artificial exchange rate paid by the company; a small increase in the allowance for wife and children; an increase of 3 pesos per shift for night work; paid vacations of lengths depending on service up to 13 days for employees of 288 days' standing; indemnities based on length of service for men who quit, die, or are retired under articles 9 and 10 of the labor code. The new contract runs from Nov. 30, 1946, to Feb. 1, 1948.

## PHILIPPINES

### Mining men anxious regarding March vote on foreign ownership —Demand good for chrome ore

★No additional mines have lately begun active rehabilitation work, and it appears that other mining companies will wait until the plebiscite has been held on March 11th to vote on the constitutional amendment restoring former property-holding rights to American nationals. Hope for immediate payment of war damage claims to the mining companies is fading fast. It has been pointed out by the War Damage Commission that the settled policy will be to pay first the small claim of $500 maximum. The Commission observes that more than a million such claims have been filed and that unless the total were much scaled down, it would leave little for payment on the larger claims out of the $450 millions allotted under the Bell Act. In any event final payment will be dragged out for many months, as the task of examining and adjusting the claims is staggering.

★Work is progressing well on the Benguet-Balatoc mill, in the Baguio area, where 2,000 men are employed, but delays in obtaining lumber and mill equipment have forced the management to advance the probable date for production until after summer. Great ingenuity has been displayed by the company engineers in restoring burnt equipment to temporary usefulness until replacements can come from the United States. The Keystone shaft on the Benguet ground has been completely repaired and is ready for service. The Balatoc mine could furnish substantial tonnages today from stopes already in condition for mining. An increase of 10% in wage rates was put into effect on Jan. 1 and labor relations appear entirely satisfactory at the mine.

★At the Consolidated Mines chrome deposits at Masinloc, production sights have now been raised to 20,000 tons per month due to insistent demand from the purchasing agency in the United States. At the same time inquiries for substantial tonnages have been received from London and Holland. Twenty-seven used Army trucks are hauling ore from the mine to the loading pier, but breakdowns are frequent, as the trucks are overloaded most of the time. New 10-ton diesels are being tried out, and it is likely that a fleet of them will be installed as soon as delivery can be made.

★According to local reports, the Tambis gold dredge will resume work south of Surigao. Before the war this was a small, steady producer and because of its remoteness it does not appear to have suffered much during the occupation. It also seems possible that one of the dredges at Coco

Grove which was not seriously damaged will be placed in operation. Sufficient yardage had been determined before the war to provide for five or six years' work for a single dredge. The gravel averaged about 24 to 40c. a yard in gold and the property had a profitable production record.

★Considerable talk has been heard of bringing smelting equipment from Japan to the Philippines as part of the war reparations, and some preliminary surveys have been made by Government engineers. However, practical considerations will probably defer any action until such matters as availability of ore, assurance of fuel supply, and competent technical supervision has been worked out.

★Mining stocks on the Manila Stock Exchange have been in good demand, especially shares of those companies that are definitely looking for production in 1947. A considerable speculative element enters as well through possibilities of an increase in the price of gold in the Philippines. At present the statutory price of 70 pesos an ounce holds for the gold miners, but street prices in Manila are much higher, and in China the market is about $65 or $70. Government officials will not commit themselves as to possibility of a free market when production begins, but it is possible that they will be favorable towards allowing the mines to sell on the open market. It is pointed out by an official of one of the larger companies that present costs of labor, supplies, and fuel oil in the Philippines have advanced so sharply that it requires either substantially higher grade of ore or an increased gold price for an operation to be profitable today.

## AUSTRALIA

### Plan doubled output for Broken Hill mine—Paringa strikes rich gold vein—Gold output up

★To finance and direct operations aimed at doubling output from Broken Hill to 1,000,000 tons within 7 to 10 years, to expand operations to other mining activities, and to open up new territories, Zinc Corporation, Ltd., announced in January the formation of a new $16,050,000 subsidiary, Broken Hill Corporation, Ltd. Expense for doubling Broken Hill's present zinc-lead ore output of 500,000 tons annually is estimated to be about $23,000,000. Exploration will be carried on elsewhere in Australia and the United Kingdom, not only for base-metal properties, but for deposits of oil and coal as well. Research, power supply, and manufacturing activities will be expanded.

★The Dorr Company has offered to design, erect, and start up all plant necessary for the aluminum industry in Australia, according to a recent report of the Australian Aluminum Production Commission. The company tested samples of Tasmanian and Victorian bauxites and reports them amenable to treatment by the Bayer process. The Dorr Company's suggestion is under consideration.

### WESTERN AUSTRALIA

★Three new gold strikes are reported from the Menzies district, in Western Australia. One is at Springfield, 5½ miles southeast of Menzies; the other two are on the Lady Shenton-First Hit line. Ore at the First Hit mine runs about 1 oz. per ton.

★Telluride gold ore, grab samples of which are reported to have run 524 and 324 oz. per ton, has been struck on the 418-ft. level in the No. 1 shaft on the eastern side of Paringa Mining & Exploration Co.'s old Block 45 lease at Kalgoorlie. The vein of telluride ore is reported as only three to four inches wide, but the company reports officially that the first 29 tons mined from the seam ran 2 oz. 1 dwt. per ton.

★Central Norseman Gold Corporation, operating at Norseman, 160 miles south of Kalgoorlie, is opening the Lady Miller mine, four miles from the main leases. Diamond drilling has disclosed a sulphide lode 24 ft. wide with


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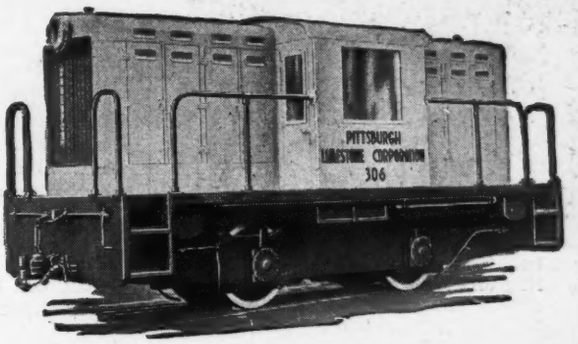


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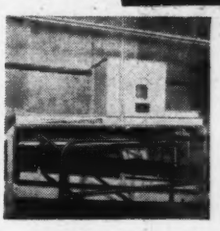

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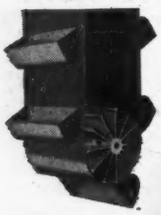
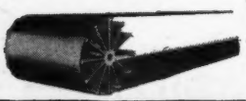


Used as an elevator pulley

Used as tail pulley on belt conveyor



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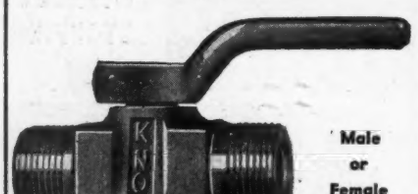


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## Australia (*continued*)

an assay value of 6.5 dwt. gold per ton for a length of 200 ft. If developments continue satisfactorily, it is intended to erect a sulphide mill on the property. There have been good developments by diamond drilling in the Northern Deeps of the Mararoa reef, which is the principal orebody in the Corporation's property, whereby the life of the mine has extended by seven years. A new shaft, which will ultimately become the main haulage shaft, will be sunk 1¼ miles north of the present main shaft.

### NEW SOUTH WALES

★North Broken Hill, Ltd., increased ore production during the financial year ended June 30 last from 330,225 tons in the 1945 period, to 357,743 tons. The output is still much below production rate in the early years of the war, when production exceeded 500,000 tons per annum. Profit has increased, due to greater output and higher metal prices, assisted by slightly higher recoveries. Although previously of a high order, recoveries in the last year were:

| | Recovery, Percent | |
|---|---|---|
| | 1940 | 1946 |
| Lead | 95.5 | 97.0 |
| Silver | 88.1 | 91.5 |
| Zinc | 86.5 | 86.5 |

Ore reserves were estimated at 5,111,000 tons, compared with the previous year's estimate of 5,183,000 tons. Average assay values of the ore mined during the year were:

| | Lead, % | Silver, Oz. | Zinc, % |
|---|---|---|---|
| North section | 15.3 | 8.3 | 12.2 |
| British-Junction section | 11.7 | 6.1 | 9.5 |

Exploratory diamond drilling below the 2,600 ft. level has shown that the northerly pitch of the main orebody has not flattened. The exploratory north drive at the 2,600 ft. level has reached a distance of 3,850 ft. from the No. 2 shaft. The work has shown that the De Bavay fault, which is considered the dominant structural feature on the mine, is of greater width than was originally anticipated. Much work is yet necessary in this area. The No. 2, or main haulage shaft, has been sunk to a depth of 3,070 ft. from surface, and a level is to be opened out at this depth. A new industrial agreement has been completed, under which underground working hours remain at 35 per week, and surface hours have been reduced to 40 per week. The average basic wage is £A5-14-11 per week.

### VICTORIA

★The gold yield of the State continues to increase. Mines which were closed down through wartime conditions are being reopened, as the supply of labor permits. A large increase in activity is still retarded by insufficient labor and by the effect of official restrictions on the industry, chiefly taxation, and the limitation upon trading in shares of mining companies, which prevents re-sale until five months after purchase.

★The dredge of Harrietville (Tronoh), Ltd., has started work on a scale of one-third full capacity. The dredge is one of the largest in the world, with a capacity of 350,000 cu. yd. per month. The pontoon is 300 ft. long, 72 ft. wide, 12.5 ft. deep; digging range is 130 ft. below water level. Buckets are 20-cu.ft. capacity. The property contains 96,000,000 cu.yd. with an average gold value of 1.92 gr. gold per cubic yard. Since work was resumed, the dredge treated 138,300 cu.yd. to June 30 last, for a recovery of 240 oz. of gold, or an average of 0.835 gr. per cubic yard. From June to October, throughput was 511,700 cu.yd. for 1,004 oz. of gold, an average recovery of 0.94 gr. per cubic yard. Costs have been 6.56d. per cubic yard, which is due largely to the restricted scale of operations. Full-scale work is expected by the end of the year.

### TASMANIA

★Tin production is retarded by shortage of labor. The recent increase in the British price for tin has not yet been made available to Australian producers, and it is uncertain whether the controlled price for the product of Australian mines will be altered. With removal of controls, Australian tin producers would receive about £A450 per ton, compared with £A330 at present.

The most important tin producer in Tasmania is Aberfoyle Tin, N.L., which is working a series of parallel lodes in slate country, the width varying from 15 in. to 40 in. and the length reaching a maximum of 700 ft. Tin is present as cassiterite, associated with some wolframite. In the financial year ended June 30 last a total of 21,443 tons of ore was milled for the production of 339 tons of tin concentrate and 60 tons of wolfram concentrate. Workings have reached a depth of 650 ft. and ore reserves are estimated at 140,000 tons A recently completed geological survey recommends extensive diamond drilling at depth. This work is prevented for the present by lack of skilled men. The mine maintains a high development ratio of profitable to total footage; at the No. 5 level, 700 ft. of a total of 1,200 ft. of driving was in payable ore, and on No. 6 level, 600 ft. of a total of 1,000 ft. driven was in profitable lode.

With the closing down of the Briseis Consolidated company, the largest alluvial tin mining company in the island is Endurance Tin Mining Co., which operates an electrically driven plant, carried on a steel barge. Capacity is about 500,000 cu.yd. per annum. The ground has an average value of 0.29 lb. tin oxide per cubic yard and

operating costs in the recent working period were 10.54d. per cubic yard.

### NEW GUINEA

★Satisfactory progress has been made in rehabilitation of the plant of Bulolo Gold Dredging, Ltd., which was damaged and partly destroyed during the war, but no date can yet be fixed for resumption of work. The eight dredges are in good structural condition, but replacement of the hydroelectric power plants is the big work in hand. The Upper Baiune plant, with a capacity of 2,800 h.p., is well advanced, and its completion will permit the reconditioning of the dredges to be hastened. Equipment for the Lower Baiune power plant is in course of shipment. Meantime, construction of workshops, storehouses, and housing accommodation is proceeding.

## AFRICA

### Strike closes Rand mines—New O.F.S. leases — Gold output is still declining as costs rise

★Labor trouble, which hampered production on the Rand all last year, broke out again in Johannesburg on Jan. 27, when a group of the white mine workers began a strike that gradually spread to all but four of the Rand's 46 gold mines. Three weeks later the men were only beginning to return to work, and meanwhile the strike had cost operators about $200,000 per day, not to mention the loss in wages and taxes. Causes of the strike are somewhat obscure, but the difficulty was reported to lie in the efforts of a dissident minority in the Mine Workers Union to gain control of the union. It is alleged in Johannesburg press reports that this insurgent group, calling themselves the United Mine Workers (no relation to John L. Lewis), is backed by the Nationalist political party, now in opposition to the South African Government, and that it includes various "white-supremacy" factions. Professing to be alarmed over communist activity in the Mine Workers Union, this United Mine Workers Committee fomented the strike, not out of any grievance with employers or Government, but to force a change in union regulations that would put them in power. Reliable details are most difficult to obtain, however, and the causes and outcome are likely to remain clouded. It is clear only that the Rand's mines, beset with rising costs, can not stand much of this sort of trouble.

★The Transvaal gold output for December, 973,955 oz., brought the year's production up to 11,917,914 oz., a decrease of 295,631 oz. from the total for 1945. Production has declined steadily since 1941, when a peak of 14,386,361 oz. was reached. Profit per ton milled has also declined over the same period. For 1946 it was 9s.3d., nearly down to the 8s. level it reached before gold was raised to $35. Tons milled also is declining, the 1946 figure being just under 57,000,000.

★After a wait of about six months, African & European Investment Co. was advised late in January by the South African Mining Leases Board that it had been granted three leases in Block 7 of the Orange Free State gold field. A new company, Welkom Gold Mining Co., has been formed to work the leases. African & European, Western Holdings, and Blinkpoort Gold will share in the development, which lies just east of the St. Helena Gold Mines area. The new company will have a capital of $10,000,000 in $1 shares, 8,000,000 of which will be issued at first. Working capital will be provided by subscription of 5,000,000 shares at $1, and by raising a loan of $16,000,000 against an issue of debentures. The technical and administrative control of the new company is in the hands of Anglo-American Corporation of South Africa, Ltd.

★Annoyed by criticism from various quarters of the conditions that prevail among native laborers on the Rand, the Gold Producers' Committee of the


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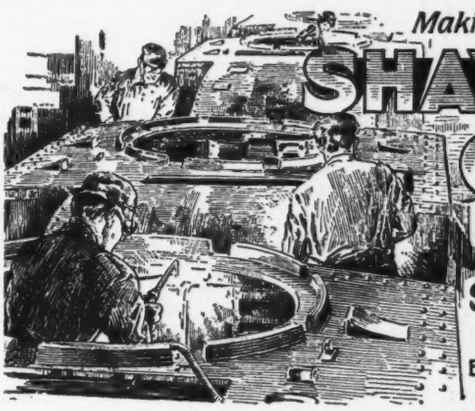

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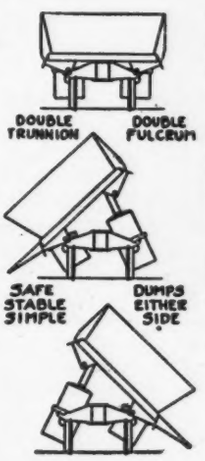

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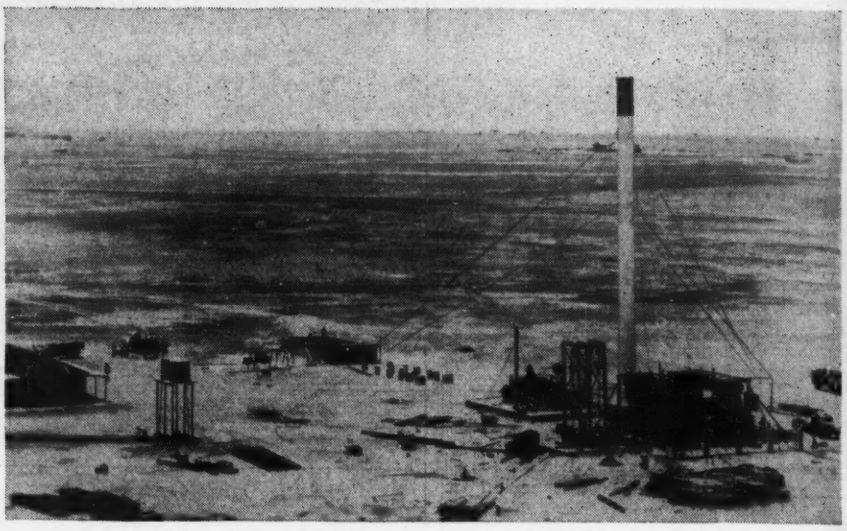

**FIRST FREE STATE GOLD MINE is being opened up here near Odendaalsrust, Orange Free State, where Union Corporation, through St. Helena Gold Mines, Ltd., is sinking a 30-deg. shaft to reach the sub-outcrop of the Basal Reef. When this picture of the shaft collar was taken, work had little more than started. Expense for St. Helena up to Dec. 31, 1946, was $725,600.**

## Africa *(continued)*

Transvaal Chamber of Mines has issued an official statement to the effect that native mine workers are well treated in respect to food, housing, medical care, and safe working conditions. The statement points out that it is not true that the average native wage for 46 years has been 46c. daily, as the statement alleges is the belief in the United States. Actually, as a reresult of a recent wage increase, the average native wage is now about 55c. daily.

★It was announced early in January that the newly formed American-African Mining Exploration Co. intends to open up a large new gold mine near Barberton, adjoining the old Fortuna mine. Samples from outcrops of two reefs of the new mine have assayed 12.6 dwt. over 12 ft. and 12 dwt. over 10 ft. Estimates of ore reserves total more than 1,000,000 tons of ore carrying 6 to 12 dwt. per ton.

## RUSSIA

### Soviet engineer builds replica of mole for tunnel work—New iron orebody in Siberia

★Something startling, if not exactly new, has been reported recently in "Pravda," leading Soviet newspaper, in the form of a mechanical mole that produces mine workings by eating its way through the ground at a rate of 30 ft. per hour. In all seriousness, "Pravda" reports that a Soviet engineer, A. I. Trebelev, spent years studying moles by dissecting them and by observing their digging methods. His researches, it is reported, have resulted in the construction of a mechanical replica of a mole about 16 ft. long and 4 ft. in diameter that is equipped with a toothed alloy-steel digging mechanism acting either as rotary or as rotary-percussion drill. The machine carries an operator and is equipped with a steering apparatus, telephone, observation ports, gyrocompass, and screw conveyors. Although it is not clear from press reports, the claim is not made, apparently, that this device can travel through solid rock. Readers who are interested may care to note some similarity to a tunnel-driving machine described in *E.&M.J.* for June 26, 1909, p. 1296.

★The Soviet Ministry of Geology reports discovery last year of a deposit of high-grade iron ore on the lower reaches of the Angara River, in Siberia, about 350 km. from Krasnoyarsk.

★Mines of the Nikopol Basin, the world's largest manganese deposits, are reported to have completed their 1946 production schedules ahead of time, topping last year's output by 50%. Mines and mills have been rehabilitated, and new types of equipment, such as magnetic separators, have been installed.

★With what the Soviet press referred to as a "great blasting job," stripping of overburden has been completed at the Dashkesan magnetite deposits near Baku, Azerbaijan. The blast in question sent 80,000 tons of rock and earth "crashing down into the gorge of the Kashkar-Chai River." The deposit is expected to yield annually about 2,000,000 tons of 65% iron ore. Use of the latest type of mining equipment is planned, and the operation will be entirely mechanized.